AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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VOLUME 21. NEW YORK, THURSDAY, OCTOBER 6, 1898. NUMBER 40.

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The Sinking of the Merrimac.

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The Merrimac was a single-screw, steel cargo steamer of about 6,000 tons burden; she was 330 feet in length, 44 feet beam and was built in 1894 at Newcastle-on-Tyne for a Norwegian firm, be-

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ing first named the Solveig. She had one vertical, triple-expansion engine, with cylinders 24, 40 and 64 inches in diameter, and a stroke of 3½ feet. She had two Scotch boilers, 15 feet diameter, 10½ feet in length. The engines and boilers were in the same compartment. In 1896 this steamer was burned at Newport News, Va.; the entire cargo of corn was consumed by the fire, and everything above decks was destroyed, but the engines and boilers were not damaged in the slightest degree. The ship was bought and refitted by the Lone Star Steamship Company. Almost her last service with this line was carrying a cargo of iron ore from Santiago de Cuba to Sparrow's Point, Md., about three months before she was sunk. The scantlings of the Merrimac were very heavy, and she was a very stanch, strong ship.

On April 9 the Merrimac was sold to the United States Government, and on April 11 she was formally commissioned at the Norfolk Navy Yard as a collier, with Commander James M. Miller in command. None of the original crew was retained except the officers' steward. The ship was docked, a few changes and repairs were hurriedly made, a battery of two 6-pounder rapid fire guns put aboard, and a coat of war color put on.

On April 14 I received a telegram from the Navy Department informing me that I had been appointed chief engineer of the Merrimac. The Navy Department had allowed seventeen men as the engine room force of the ship, five of whom were machinists. Only two of these had ever had the slightest experience with marine engines. I questioned one of the other machinists about his previous experience at sea. He said: "Oh, yes! I have been on a boat before. I was on a tugboat on the Mississippi." I began to hope. Here at least was one more man of some experience. I asked him: "What did you do on board this tug?" "Oh!" he replied. "I was just ridin' around." The experience of the others was even more limited. When I took charge there were only ten men on board. With these I managed to get the boilers cleaned and the ship made ready for sea. On April 23 the ship was towed from the yard to Lambert's Point, where 5,500 tons of Pocahontas coal were put aboard.

On April 25 steam was raised, the engines warmed and moved, and all was ready to start for Key West. But on trying to start the engines, in response to a signal from the bridge, it was found impossible to get them to turn over. On investigation it was found that the strap of the go-ahead eccentric of the intermediate engine was broken in two near the foot of the eccentric rod. The surfaces at the point of fracture showed less than a square inch of good metal—an old break. As has been said, the engines of the Merrimac were triple expansion; the high pressure valve was a piston valve; the intermediate and low pressure flat slide valves. The high and intermediate valves were in the same chest. The engine throttle and the high pressure valve both leaked very badly. Consequently, when the engines were allowed to stand for a little time, the leakage caused the pressure to accumulate in the intermediate chest; this caused a heavy load on the back of the intermediate valve and thus on the valve gear. The engines were disabled at Santiago a second time from the same cause. This first breakdown at Lambert's Point, which would have inevitably occurred sooner or later, was a very lucky one, as it caused us to miss the awful gale that raged two days later.

Finally, on April 30, a new strap having been made, the ship left for Key West, where she arrived on May 4; the speed on the way down was about 10.25 knots. It was noticed on the way down that the cap of the intermediate crankshaft bearing was working with the motion of the engine. Investigation at Key West showed that the threads of the big cap-bolts and their nuts were worn and corroded away to a dangerous extent. Tin liners were jammed in between the threads of the nuts and the bolt, and the ship ran in this way until she was sunk.

The Merrimac remained at Key West until May 20, when she proceeded to

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Cienfuegos, on the south coast of Cuba, where she joined the squadron of Commodore Schley. She did most excellent service in coaling the ships, being employed every day when the weather would permit. I have stated the trouble that was had with the machinery in order to correct a current impression that the ship was broken down, helpless and worthless. The Merrimac was the best

collier that the Government had, and was admirably adapted for the service. Her boilers were in most excellent condition. Her engines were not in good condition; they were like those of any tramp steamer that has been running constantly without repairs. The men on board were inexperienced, and it was impossible to watch them all the time. I could trust only two of the machinists to keep watch below; to relieve them somewhat I had been in the habit of taking a night watch myself. It is not surprising, with the force on board and the condition of the engines, that breakdowns should occur.

The first week that the squadron lay off Santiago was one of uniformly fine weather. The Merrimac had been very busy every day in coaling the different ships. On the forenoon of the first day of June, about 10 o'clock, the New York, that had just arrived with Admiral Sampson on board, steamed very close to the Merrimac, and everyone on the flagship scrutinized us very closely. Why, we knew later. The Massachusetts was lying alongside at the time, taking in coal. About 12:30, while we were sitting at lunch, Assistant Naval Constructor Hobson came over from the flagship with the startling announcement that the Merrimac was to be run into the entrance of Santiago harbor and sunk there across the mouth. When we had recovered somewhat from our surprise, Mr. Hobson briefly outlined his plans, as follows: Powder charges, in copper cases, were to be suspended along the sides of the ship, about 10 feet below the water, with electrical connections for exploding them; a heavy anchor was to be suspended at the starboard bow and another as far aft as possible on the starboard quarter, ready for dropping when the lashings should be cut; all sea valves were to be made ready for quick removal; the big cargo ports in the ship's side were to be opened; the ship was to be run in from the westward, swung across the channel with the helm, the anchors were to be let go to hold her in position across the channel, the powder mines were to be exploded and the sea valves knocked out to sink her, and then the survivors were to get out as best they could.

Preparations for carrying out these plans were begun at once. In company with the executive officer and myself, Mr. Hobson made a thorough inspection of the ship. Paint marks were made on the deck to indicate the position of the transverse bulkheads, and the positions of the powder mines, between the frames, were marked. Gangs of men were set at work placing and securing the anchors. The preparations in the engine room were very simple. All the bunker doors were opened, and where it was possible plates were taken off the bulkheads to give the water free access to all parts of the ship. Wooden props, of pieces of scantling, were prepared and driven in over the bonnets of the main injection valve and of the sea supply valve to the fire pump; these props were so placed that they could be easily knocked out, from the floor of the engine room, with a sledge hammer. Some of the men were put to work at removing all the stores and tools that were not needed from the storerooms. I assisted Mr. Hobson in marking places for the powder mines, had the cargo ports opened and assisted as much as I could on deck. The work of getting the ship ready was carried on all night and until nearly daylight of June 2. All the old crew had left the ship by dark on the 1st, and only the working gangs from the flagship, and the crew that was to take the ship in, remained. I had the oil service of the engine carefully cleaned and filled, the fires in the boilers cleaned and gotten in good condition, the safety valves lashed down to prevent their blowing off and warning the enemy, and the nuts on the bonnets of the sea valves slacked off until the joints were broken and the water trickled through. I had selected Phillips, machinist, first class, and Kelly, an acting water tender, as the best two men to go in with the ship; the former on account of his intelligence and knowledge of the ship and the latter on account of his faithful, reliable nature and his great wish to be allowed to go. These two men worked below all night in getting everything ready. The top cock on the gage glass of the starboard boiler had begun to leak very badly, and there was no way in which to shut it off; this materially increased the discomforts of the engine room, while the escaping steam made much noise. I got a mattress from one of the state rooms and by ramming this around the valve managed to stop the noise somewhat.

Finally, all preparations on deck were completed. The fires in the furnaces were burning brightly, steam was up to 150 pounds, life preservers and pistols lay handy for the men, who were stripped to shoes and drawers, ready to swim; final instructions had been given to each one and all was ready. The engines were started ahead full speed and the ship was headed in for the entrance of the harbor. We were "off" at last.

I remember looking up through the engine hatch and remarking to the machinist, Phillips, that it was broad daylight. After we had been running about ten minutes or more, and just when we below were expecting that the forts would begin firing at us, the engines were stopped by signal from the bridge. Very soon after a message came from Mr. Hobson that the engines would be needed but a little while longer. We then understood that the attempt had been given up. The admiral had decided that he would wait until the next day and send the ship in under cover of darkness.

The fires were banked and everything made secure below. Phillips and Kelly alternated below in keeping watch, until a relief machinist and water tender came over from the Marblehead about noon. With the aid of these men I had the starboard boiler blown down and the valve on the gage glass made tight. A bonnet on the main feed pump had begun to leak very badly, wasting nearly all the feed water. We attempted to remedy this, but could not get the studs on the bonnet out. Kelly and Phillips went over to the New York about noon to try to get a little rest, but they were objects of such curiosity and attention from the men of the ship that they returned in despair to the Merrimac about 2 o'clock, where they lay around all the afternoon and evening trying to sleep. The nervous strain and the "sagging down" after the recall of the ship had made the men sleepless, and they got but little rest. This waiting was a very severe strain on the nerves of the men.

Mr. Hobson had decided to make some changes in his original plans. He decided to explode each of his mines separately instead of exploding all of them simultaneously. There were seven mines on the port side, and the battery and wires of each were placed just inside the rail of the ship and directly over the mine. Mr. Hobson feared that the shock of the explosion of the mine might hurt the man who exploded it. The two men in the engine room were given a station at the two mines farthest aft; when they had completed their duties in the engine room they were to go on deck, explode their mines and then join the other men in the starboard gangway. The catamaran and lifeboat were slung on the starboard side, and the men were to rendezvous near these two boats.

About 7 P. M. I got some firemen and machinists of the old crew of the ship to come over. These men relieved the Marblehead's men, and remained on the ship until 2:35 A. M. of June 3. The fires in the boilers were again cleaned in the night and all the arrangements of the previous day carefully gone over again. I lay down on the bridge about 9 P. M., but found it impossible to sleep. Mr. Hobson was attempting to get a little sleep in the ward room. We were waiting until 3 o'clock, when the ship was to be run in.

About 2:30 A. M. Mr. Hobson came on the bridge and took a look around. He gave some final instructions to the men. The relief crew were called up from the engine room and got on board the launch of the New York that was waiting alongside, with Cadet Powell in charge, to take them to the Texas. The Texas was the nearest ship, and lay between the Merri-

mac and the shore. The launch shoved off with the men, leaving only Phillips, Kelly and myself in the engine room. The engines were started ahead at dead slow, and the ship was headed in for the harbor entrance. When the steam launch was about 100 yards from the ship Mr. Hobson hailed her from the bridge and asked Mr. Powell if I were in the launch. "No!" came back the answer. "Come back and get him!" sung out Mr. Hobson. So I was not permitted to go in with the ship on the second trip. I jumped into the launch and was taken to the Texas. The launch followed the Merrimac in to pick up any survivors there might be.

What happened after I left the ship was described to me by Phillips, and I will try to give his description as exactly as possible. About 2:45, then, the Merrimac was headed in toward the harbor mouth, the engines running at dead slow. The speed was increased to full speed after it was judged that the steam launch had reached the Texas. The engines were running at about 60 revolutions; this should have given the ship a speed of at least 10.5 knots. The boiler steam gage showed 155 pounds. Kelly was slicing and coaling the fires in the two boilers and Phillips stood by the engines. Charette, one of the men on deck, came below with a message from Mr. Hobson: "Open her wide," he said. "She's doing all she can now," said Phillips, "and has more steam than I have ever seen on her before." "How long will it take us to get in?" asked Phillips. "About twenty minutes," said Charette, and returned to the deck. Kelly had time to coal and slice all his fires before the first shot was fired from shore.

About five minutes after Charette had left the engine room the men below heard the boom of the first gun from Socapa Battery. This battery was on the west of the entrance, the side from which the Merrimac was approaching. Kelly came into the engine room from the fire room to have a look at the water level in the boilers. The gage glasses were in the engine room. "Did ye hear that, Phillips?" said Kelly. "That'll be the New York firing blanks at us!" The men had been told on the first day that the New York would make a feint of chasing the Merrimac, to give the Spaniards the impression that the Merrimac was a blockade runner trying to get in; this idea had been giving up, but the men below did not know it. Several more shots followed quickly and the men below felt a shell strike the ship. "Those are fine blanks, Kelly," said Phillips. Kelly then ran to take a look at the water level in the boilers. The salt feed was open to the condenser; but the bonnet of the main feed pump, before mentioned, was leaking so badly that the feed had run low in the boilers. Kelly went over to the port side of the engine room to start the big fire and feed pump on the boilers. Phillips stood by the reversing gear waiting for the last signal that would ever be sent below. The firing above was now very rapid and heavy from automatic guns, rapid fire guns, riflemen on the bluffs and from the Reina Mercedes.

Just as Kelly had started the feed pump the engine gong rang loudly and the indicator was swung back and forth; this was the signal to stop the engines, knock off the bonnets of the sea valves and go on deck. Phillips stopped the engines and sang out: "Let her go, Kelly! Knock out your props!" With one blow of the sledge that had been placed near the pump Kelly knocked out the prop over the bonnet of the sea supply valve of the feed pump and then the prop over the main injection valve, singing out as he did so: "They're gone!" Phillips rushed up the engine room ladder on deck. Kelly sprang back as he knocked out the props, to avoid the inrush of water through the big injection valve. The engine room flooring here was of wood and very slippery. "Get up on deck!" shouted Phillips, as he ran up the ladder. The water rushed into the engine room with a roar. Kelly had slipped on the planking of the floor as he sprang back and had fallen. Springing to his feet he ran into the fire room and with an axe cut the pipe leading from the bottom blow of the donkey boiler to the sea. Glancing at the steam gages he saw that the steam was above the usual limit of 155 pounds; so he opened the doors of the front connections of the boilers and the furnace doors. He did this, I suppose, because he had been trained never to let the steam run up over the limit set. The steam could not have risen too high to suit Hobson; had the boilers exploded, nothing better could have happened for the success of the scheme for sinking the ship. Still, Kelly, even at the last moment, did what he thought was proper and what he had been trained to do. Meanwhile, the engine room was filling.

Phillips had thrown off his shoes and hastened up the long ladder from the engine room to the deck. He was blinded at first from coming into the dark from the bright engine room. He groped his way aft to mine No. 7, to where the battery box lay on the deck, close to the rail. He put on his belt, pistol and life preserver, which were lying there. Scraping the tape off the ends of the wire, he made the contact; he says that the mine did not explode. Crossing the deck he started forward along the starboard gangway, when he heard a sst! SST! SST! from someone lying on the deck outboard close to the rail, near the door of the petty officers' mess room, which was about amidships. Three of the men on deck, having completed their duties, were lying against the rail on the deck. He lay down with them. Ere long Mr. Hobson and the remaining men of the deck force came up. Kelly had not yet appeared.

All this time the firing at the ship was very rapid, especially from the riflemen on the bluffs on either side of the entrance; they were firing at the ship by volleys and at will. The rifle bullets pattered on the decks like hail. Phillips said that some of them struck within arm's reach of where they lay. The ship could be felt to tremble occasionally from the impact of the shells that struck her. A big shell burst forward, at the break of the forecastle, like an enormous skyrocket. Some of the men wished to jump overboard, but were restrained by Mr. Hobson. The ship was settling all the time.

In the meantime, Kelly had made his way through the engine room up to the deck. He went aft to the last mine on the port side, put on his belt, pistol and life preserver and connected his mine wires. He then went forward on the port side of the deck, crossed over the deck just abaft the deckhouse that formed the officers' quarters and went up the starboard ladder to the deck just under the bridge. Finding no one there, he retraced his steps. He dodged across the deck aft and started forward along the starboard gangway, as Phillips had done. On June 2 there were only seven men in the crew. The men lying in the gangway had counted noses and there were seven. So when Kelly came groping along the deck Mr. Hobson, forgetting that there were eight, leveled his pistol at Kelly and said: "Who is that?" Charette said: "It's Kelly!" and Kelly lay down with the others. Kelly listened for a second to the fusilade, and then asked: "An' how long has this been goin' on?"

The ship was now settling rapidly. The steam pipe to the whistle was shot away, and the steam began to escape from the boilers with a loud noise. Mr. Hobson was under the impression that a shell had penetrated one of the boilers, and told me so; from what Phillips said, I think it was the whistle pipe that was cut. In a moment there came a heavy, muffled explosion that lifted the whole ship. One of the men told me that he could feel the ship lift and rise under him—it seemed several feet. The ship immediately heeled over to starboard. The men thought that she would turn over, and they were for jumping overboard. Again Mr. Hobson restrained them, knowing that she had enough coal on board to keep her from capsizing. After listing over the ship plunged down, bows first. The water rushed over the men from forward before they had time to get to their feet. The return surge washed them forward, and Kelly was sucked into the chute of one of the fire room coal bunkers, the hatch of which had been left open. He clung

on to the coaming of the hatch, and thus escaped being sucked down. Phillips said that he was sucked down with the ship, and but for his life preserver he would not have risen; as it was, he was strangled almost when he reached the surface. The men rose to the surface close to one another, and made their way to the catamaran. The catamaran capsized as the ship went down; it half-way righted and then fell back again, the men clinging to it while it was vertical in the water. The line by which the catamaran had been suspended now acted as a mooring line, holding the catamaran to the ship and preventing it from being carried into the harbor by the strong flood tide. The men clung to the catamaran for two hours, until daylight came, with the life preservers drawn up over their heads and only their heads above water. How they were subsequently picked up by Admiral Cervera is known to all.

Their miraculous escape from the storm of shot and shell, from drowning, from sharks, seemed but a part of the wonderful good fortune that followed our men throughout the entire war. Phillips was promoted to the grade of chief machinist, to which, however, he would have attained sooner or later, even in peace times. Kelly was also made a chief machinist; much more of a promotion, however, as he was only a fireman. Phillips is now serving on the Iowa and Kelly is on one of the small prizes in Cuban waters.

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Our Naval Armament.

It takes three things to make a navy—the ship (including armor and the engines), the artillery and the personnel. This article will deal with the question of guns alone, since the ship factor and the personnel factor are somewhat too extended for discussion within the limits assigned. We can say, however, that ship for ship, our navy is better than most, if not all, others, and that on the personnel side it is the best going. Nevertheless, this superiority may be unavailing if the gun is not powerful enough. Weakness here may be fatal in the hour of trial—"the drumming guns have no doubts."

The Americans are a great people, a great business people; nothing but the best machines will answer their purposes. The machine bought to-day is laid aside to-morrow for a better. How do we apply this business principle when it comes to arms for our army and navy? One would be tempted to say, "Why, they surely have the best, the very best, there are to be had." But the cold facts are that they haven't.

It is a fact that the guns of our navy are only of medium power as compared with the guns of other nations. We have fought Spain with inferior guns and inferior powder. There is no need of speculating on what would have happened had her guns been served by capable gunners, though the field is tempting. The matter that concerns us is what is, not what was or what might have been, and "what is" is that fact that our navy has inferior guns, even down to the shoulder-arm. The thing for us to do is to compare our armament with the armaments of other navies, however "odorous" the comparisons may be. In these days smoke from guns is more than a nuisance; it is a positive handicap; yet our navy is just now beginning to advertise for smokeless powder. Even with this, however, our guns cannot be brought up in power to equal like guns abroad. The gun designed for pressures due to black or brown powder is weak toward the muzzle as regards its use with smokeless powder. The curve of pressures falls much more rapidly as the muzzle is approached in the case of black or brown powders than does the curve of pressures derived from smokeless powders. Our guns are therefore made lighter or thinner toward the muzzle than are the guns designed for smokeless powders. Again, our guns are all built up or hooped, whereas the English navy is being armed with wire-wound guns capable of standing far greater powder pressures, weight for weight and caliber for caliber, than our guns. Also, the English firms (Armstrong-Whitworth, and Vickers, Sons & Maxim) are furnishing wire-wound guns to Chili, Japan and other nations. Our hooped guns are doubtless superior to similar guns built in some foreign countries, but the trouble is that those countries have discarded the hooped gun and have taken a better. But there are hooped guns built abroad which appear to be superior to our guns and they form the armament of possible antagonists in the Philippines.

TABLE I.
12-INCH GUNS.

	U. S. Navy	English Navy.	French Navy.	Vickers, S. & M.
Weight, tons..	45.2	46	45.9	50.3
Pow. chge. lbs.	425*	167½‡	198.4§	207‡
Wt. of Shell...	850	850	644	850
Initial velocity, ft., sec.	2100	2367	2625	2750
Muzzle Energy, ft.-tons	25,985	33,020	30,750	44,573
Muz. En. per ton of gun.	575	718	625	886
Penetration w'rght iron	30".8	36".8	—	45".9
Penetration Steel.....	24"†	28"†	—	—
Length of bore in Calibers.....	35	35.4	40	40

* Brown prismatic smoke producing powder.
† Approximate only.
‡ Cordite, smokeless.
§ Smokeless powder.

The above deductions are made very plain in the accompanying tables.

A study of this table is most instructive, particularly the columns of "Muzzle energy per ton of gun" and "Penetration, wrought iron," in inches. If the metal in our gun did as much duty as the metal in the English gun, and our gun still developed but 25,985 foot tons, the gun would weigh but 36.2 tons, instead of 45.2 tons as it actually does. With the metal performing the same duty as in the Vickers, Sons & Maxim gun our gun would weigh but 29.3 tons for the 25,985 foot tons of energy developed. The differences in penetration speak for themselves.

There is another factor to be taken into account, and that is rapidity of fire. It takes several minutes to load, aim and fire guns of large caliber, say five or six or even more for the 12-inch gun. This factor has a very important bearing in view of the limited thickness of armor a ship can carry and the very great penetrative power of projectiles from smaller caliber guns, coupled with the rapidity with which the smaller caliber guns can be fired. The ship carrying the heavier guns may be destroyed before she can get in one of her greater projectiles, since the percentage of hits is not over 10 per cent.—it was 8 per cent. at Santiago on the American side, counting all guns. These facts may be made clearer by Table II.

TABLE II.
PENETRATION AND RAPIDITY OF FIRE.

	Calibers of Guns.	Penetration. Iron.	Penetration. Steel.	Number of Shots Per Minute.
U. S. N...	10-inch	25".8	20" (*a*)	1 shot in 2 m. 16 sec.
	12-inch	30".8	24" (*a*)	1 shot in 5 or 6 m.
	13-inch	34.6	27 (*a*)	1 shot in 5 or 6 m.
U. S. N.....	8-inch	21.1	16 (*a*)	1 shot in 2 m.
Elswick	8-inch	26.4	20.3 (*a*)	3 to 4 per. m.
Krupp.....	8.24-inch	....	20.08	Quick-firer.
Krupp.....	9.45-inch	....	23.35	Quick-firer.
Schneider Canet ..	6.3-inch	21.1	....	Quick-firer
Vickers, Sons & Maxim .	9.2-inch	34.3	26.6	.....
	8-inch	26.	20.2	5 per minute
Vickers, Sons & Maxim.	6-inch	21.1	16.4	8 times per m.

(*a*) approximate only.

There is plenty of food for reflection in this table. Our 12-inch gun just about equals Krupp's 9.45-inch gun, but is slower of fire; just how much slower is not clear, since the Krupps did not give the rapidity of fire with their data. Vickers, Sons & Maxim are building the 9.2-inch gun which is intended to penetrate 34.3 inches of iron, or 26.6 inches of steel; it is to be a quick firer also. This gun will surpass our 12-inch gun and will very

nearly equal our 13-inch gun, which penetrates 34.6 inches of iron. All the guns of Table II. are actual service guns, except the Vickers 8-inch and 9.2-inch, which are under construction. The Vickers 6-inch gun equals our 8-inch gun, and we may safely assume that their 8-inch and 9.2-inch will do all they calculate they will do.

A ship like the Oregon carries four 13-inch and four 8-inch guns, all of which can be fired on one broadside. How would she compare with a ship carrying an armament equal in total weight to hers, but made up of high power 8-inch guns? The Oregon's 13 and 8 inch guns weigh 363.6 tons; the Krupp quick fire 8.24-inch, 50-caliber gun pierces 22.25 inches of steel (the Oregon has 18 inches of steel on her belt, 15 on her turrets and 6 inches on her casements), and weighs 20.18 tons; hence, an enemy could carry 18 of these Krupp guns, within the same limit of total weight. With 4 of these in turrets and capable of being used on either broadside the enemy could have 11 guns firing on a broadside. Allowing the Oregon one minute between shots with the 8-inch and three minutes for the 13-inch and taking the chances of making hits into account (say, 1 in 12 for the 13-inch and 1 in 8 for the 8-inch), it would require three rounds from the four 13-inch guns to come within the probabilities. In nine minutes the Oregon would throw 22,200 pounds of metal and would hit the enemy once with a 13-inch shot and 4.5 times with 8-inch shot, or 5.5 times total. Our 8-inch guns are not quick firing, while the Krupp guns are; we must, therefore, give the Krupp gun greater rapidity of fire than once per minute, say, two times per minute (see the Elswick and the Vickers guns above—8-inch). In nine minutes the enemy would fire 198 shots, of which 24.75 would be hits. The Brooklyn was "hit" many times at Santiago, but no vital spot was touched; hence our 5.5 hits might not damage the enemy seriously, while one or more of his 24.75 hits might reach a vital spot on the Oregon—his chances are nearly 5 to our 1. A turret of the Viszcaya was put out of action at Santiago by a shell which struck the gun port and entered that way, killing all within the turret; it is not known what the size of that shell was, whether 6, 8, 10 inch or larger; what is known is its effect—a gun out of action permanently. Had a shell hit the Oregon that way two guns would have been killed.

It is scarcely an answer to the foregoing hypothetical case to say that no such ship exists as that enemy, for the point sought to be inforced herein is the inferiority of our naval guns to those used in other navies. The American policy during the war of 1812 was to have greater gun-power than the enemy; to throw more metal within a given time than could be thrown by that enemy. In the case supposed above, the Oregon would throw 22,200 pounds of metal from her armor piercing guns and the enemy would throw 49,500 pounds from armor piercing guns, all within nine minutes.

Nor is it yet proved that the 13-inch gun can be loaded and fired once every three minutes—the 10-inch can get around in 2 minutes 16 seconds, but there is nothing to show that the 13-inch can rival it. On the other hand, foreign quick firing guns use a better interrupted screw than do we for the breech blocks of our old style 8-inch guns used on all our ships; they are therefore able to fire more quickly than we are. Then all foreign nations use smokeless powder and have their sights marked for ranges given by that powder; our sights are marked for ranges given by black powder; if we substitute smokeless powder (as we are now going to do) these sight bars must be re-marked.

It thus appears that our navy gives guns to our gunners inferior, caliber for caliber, to the guns given by the "effete monarchies" of the Old World to their gunners. Why is this the case? Has there been too much conservatism in our Bureau of Ordnance? Why are we handicapped with smoke producing powers at a time when all nations, including Spain, are using smokeless powders and have been for years?

And are we as far behind with small or shoulder arms as we are with our artillery? Apparently we are. In the first place the navy small arm is of a caliber different from that used in the army (0.23 and 0.30), so there can be no interchange of ammunition between the two branches of the armed forces of the United States. In the next place a great blunder was made in the rifling of the navy small arm. Virtually the universal practice in small arms is to so rifle the gun that the bullet will make one turn or one and a half turns in traveling the length of the barrel. This rule is the result of long practice and expensive experiments, and is undoubtedly sound. But the navy rifle was so constructed that the bullet would make seven turns in the length of the barrel—and the rifling of the guns simply refused to play: it would not stand the strain at all. The naval authorities thereupon made matters worse by decreasing the length of the bullet until the rifling would stand the strain (for the weight of the bullet was now so small that its carrying power was not sufficient for even moderate ranges—it takes considerable power to throw a feather a yard or so), and the power of the powder behind such bullets as the navy adopted is very largely spent in giving them the seven turns in the length of the barrel. A new small arm has been adopted for the navy, but meanwhile 10,000 of the 7 to 1 twisters had been made and issued to the service.

It is not to be understood that vigorous protests were not made by outside experts against the adoption of both the 0.23 caliber and the 7 to 1 idea, for such protests were made, but without avail. So here we have three distinct causes of complaint against our Naval Bureau of Ordnance—the adoption and retention of hooped guns when wire wound guns were being adopted elsewhere (the wire wound gun was known to be more powerful than the hooped gun, both theoretically and practically); the adoption of brown smoke producing powder, when smokeless powder was coming in, or had come in, successfully, and the adoption of an abortive small or shoulder arm in the face of all experience. Fortunate for us it was that our enemy was Spain. Now the question is not only what shall we do to get out of the hole, but who was it that got us there? Was it Congress alone, or was Congress advised by some scientific chief of the Bureau of Ordnance to do thus and so, and so did? If the latter, it would seem that that chief is the one really at fault. It is intolerable that we should be armed with inferior weapons at a time when we are taking on such responsibilities as possessions beyond sea. Crœsus had gold, but Solon told him that the man with iron would take it from him—and it was done.

GRADUATE U. S. N. A.

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Proportions of Journals on Heavy Machinery.

A young engineer confronted with the problem of designing a new machine with some large bearings to run continuously at moderately high speeds and pressures began searching for definite information on the subject of proportions and as a result remarked that what seemed to him to be the most definite and all together satisfactory information on the subject was given him by Mr. Edwin Reynolds, of the E. P. Allis Company, whose rule he quoted as: "The square root of the speed in feet per second multiplied by the pressure per square inch of projected area should not exceed 500."

In answer to our letter asking Mr. Reynolds for further information on the subject he writes as follows: "It is true I have used the rule you mention for a limit and never go up to 500, except in vertical engines, where the steam pressure in cylinder is sufficient to lift the shaft against the cap. Three hundred and fifty to 375 should be the limit for horizontal engines. This method of determining size and proportions of journals for main shafts of engines has proved satisfactory in a very large number of heavy machines."

It is interesting to note that the only case in which Mr. Reynolds considers it advisable to reach 500 is where, at every revolution, the shaft is actually lifted to

the amount of the play in the main journals, so that opportunity is afforded for the free distribution of oil between the bottom of the box and the shaft.

It is interesting also to apply the rule to various bearings in use, and if applied to modern locomotives it is seen that their driving boxes far exceed the rule given, running in some cases as high as 585, even where there is no relief of pressure and where the rule would limit the resultant to 375. Independent of this it is of course well known that locomotive driving boxes are necessarily restricted below the size required for satisfactory working, and if they ran continuously, as many other bearings do, it would be practically impossible to maintain them.

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American Machinery Trade in Italy.

Editor American Machinist:

I read with much interest your Commercial Review in No. 32 of your paper, and quite agree with your concluding idea: "Some believe that the Italian market does not receive the cultivation it deserves."

You are not at all wrong with your judgment. This opinion that the Italian market does not receive the cultivation it deserves is only too correct; in fact, there never was a truer one, so that I cannot refrain from adding some information. Being since about twenty years ago established in this country as representative of several leading German and Belgian firms in the iron, steel and machinery lines I know the situation very well.

Not only in America but also in Europe people do have a certain mistrust for the Italian business, and unfortunately not entirely without reason. American firms try to avoid any loss by selling only either against cash with order, payment before shipment of goods, or, in the most favorable case, against a bill of lading. Now, especially in Italy, those terms will not do at all, and more than one of the leading Italian works asked me with just reason: "What guarantee offers the American firm that the goods I ordered and paid for will answer my wishes, or that, for instance, a machine I order will do the work promised and agreed upon?"

Germany and English firms, for instance, have the following terms for machinery generally: One-third with order, one-third before sending the goods and one-third after two or three months from date of invoice, and these terms are always accepted without hesitation.

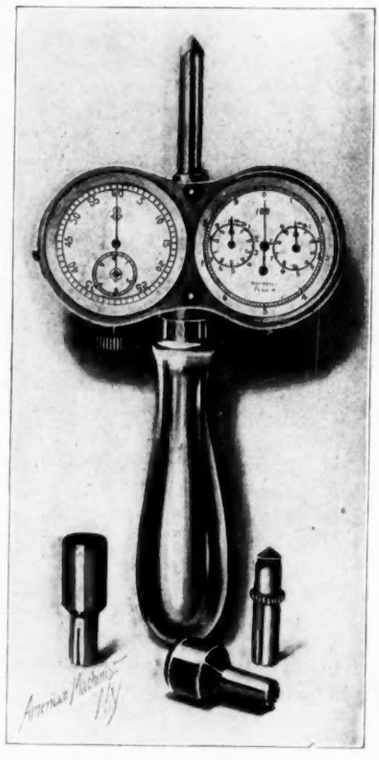
Another and chief point why the American business cannot get a footing in Italy is that scarcely one American firm has a representative regularly employed who is established in the country; instead they generally prefer to do business directly against cash with order.

I do not think there is another country besides Italy where it is so absolutely necessary to have a representative who personally calls on the clients, or who manages and concludes the business in the interest of the foreign manufacturer by writing in the language of the country.

All English, German, Belgian, French, etc., firms of some importance have in Italy their regularly employed agents, who are doing business on a commission basis and whose firms refer all direct correspondence to them.

Then certainly it is the duty of the agents to pay strict attention to the business and to have dealings only with those firms about whose solvency there is not the least doubt.

The ideas of many American works that representatives should buy for their own account and, of course, on the general terms—cash with order or against bill of lading—are generally not practicable, as the agents can neither make large advances nor can they themselves run the risk of having one or the other machine left on their hands if it does not entirely answer the conditions agreed upon.



A NEW REVOLUTION COUNTER.

Therefore a considerable business extension with Italy will be possible for America only when the leading works have their agents in Italy and exact less severe conditions for payment.

GUGLIELMO FREY.

Milan, Italy.

A New Revolution Counter.

We reproduce herewith, from the pages of the London "Engineer," a new revolution counter which is by far the most perfect instrument of the kind with which we are acquainted, and which, in fact, seems to about exhaust the field.

The instrument combines both a counter of the usual construction and also a stop-watch—the pointers of the watch starting and stopping with those of the counter on the insertion and removal of the instrument in or from the shaft center.

The revolution counter has three dials on the one face, the largest divided up to 100 and the two others marking thousands and tens of thousands. This seems excessive, but the counters are intended particularly for high speed work. On each dial the figures are duplicated in red and black, so that the number can be read at once whichever way the engine runs, although the engraver has obviously made a mistake in making both circles of figures read the same way. A little black or red indicator appears behind the small hole just under the center of the dial to show which color figures are to be taken. This hole appears like the tail of the pointer in the engraving. The instruments are very light, being made of aluminum; the diameter of the dials is approximately 1¾ inches. The long hand of the counter is moved back to zero by a thumb-screw at the back, while the smaller dials have a trigger attachment which returns the pointers automatically; this is also the case with the watch. The latter is wound by the screw underneath.

The instrument, which is also furnished without the watch, is made by O. Berend & Co., Limited, but the address of the firm is not given by our contemporary.

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An All Round Engineer Wanted.

There is a job for an engineer for the water works at Grove City, Pa., if it has not been already gobbled up. The requirements, as enumerated at a meeting of the city council, are that he must "run the engine, keep the plant in order, keep the water books, collect water rent, repair all leaks, hydrants and valves, attend all fires and act as general superintendent, under the direction of council, and pay all moneys to the treasurer, take his receipt and shall make monthly reports to council and give a bond of $1,000 for the faithful performance of his duties." The salary is not stated, but the poor fellow is evidently expected to earn all that he gets, and the bond is designed to fix him so that he will not dare to shirk or attempt to evade any of his duties—such as attending a fire and running the water works engine at the same time, for instance.

A Steam Road Carriage.

BY R. I. CLEGG.

An experimental steam carriage belonging to A. T. Cross, of Providence, embodies a number of interesting features, particularly in the methods devised to secure automatic regulation of the fuel, steam pressure and water supply.

A STEAM ROAD CARRIAGE.

The carriage complete is shown in Fig. 1; the smokestack, 12x2½ inches, occupies the space between the two small windows of the buggy top and is enameled to the same shade as the leather trimmings. Fig. 2 gives a view of the machinery after removing the carriage body; the oscillating engines are 2½x3½ inches, and are reversed by a slide valve which transposes the position of the inlet and exhaust valves; the throttle and reversing levers are shown on the right, and are operated through rods connected to the two levers seen in Fig. 1; the feed pump is attached to the right-hand engine, and is regulated by a float acting upon the suction pipe; the pulley on extreme right is for brake, while a like position on the other countershaft is occupied by the eccentric working the pump lifting water from condenser to supply tank; the gears are 6 pitch, fiber pinions and bronze internal gears, and are geared to give a speed of ten miles an hour at 400 revolutions per minute of engine; the countershaft runs in spherical bearings; the boiler is wholly of wrought iron and steel, the water back is formed by two steel plates separated by a ring of iron 2x¾ inch in section; into one of the steel plates are screwed tubes about ¾ inch apart, each tube 18 inches long by 1½, with a fine thread 24 to the inch; the tubes are plugged at the outer end; the supporting frame is of angle steel 2x2x¼ inch.

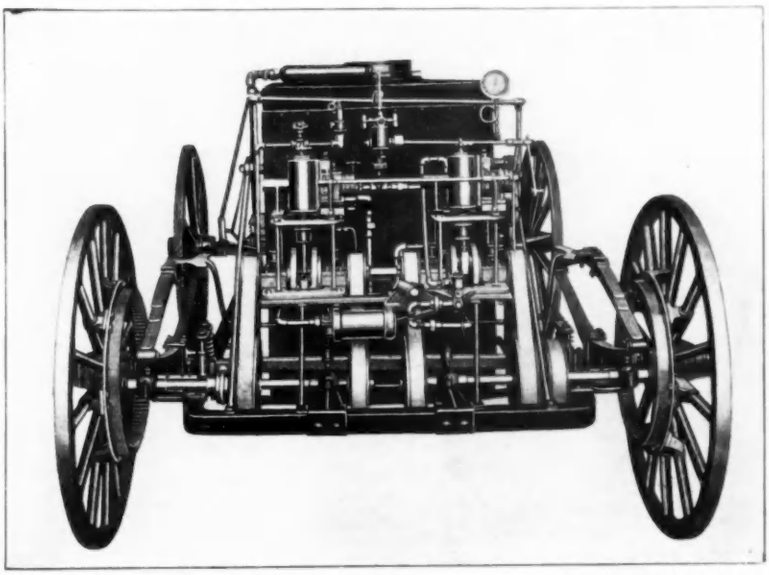
The weight of machinery and frame is suspended from the axles by spiral springs, while the body of carriage is, in addition, supported by elliptical flat springs.

Fig. 3 shows the method of controlling the fuel; crude petroleum is, by a steam jet, sprayed into the furnaces, where it is ignited by a torch, fed with the same oil. In Fig. 3 *A* is connected to steam drum; *B* is a brass casting, bearing a ring *C*; between *B* and *C* is a diaphragm *E* of spring brass; *D* is an arch tapped to fit the adjusting screw *F*; to the center of diaphragm *E* is, by a rod, attached the valve *G*; between *E* and *F* is the spring *H*; the atomizer *I* is supplied with steam and oil through the piping *J* and *P*. The apparatus, so far described, is used to regulate the boiler pressure; as the pressure rises the diaphragm is forced against the spring *H*, lifting the valve *G* and closing the steam passage to atomizer; should the carriage come to a standstill the steam pressure will slightly increase, closing the valve *G* and shutting off the fires; on the other hand, when going uphill the diaphragm will open the valve to maintain by increased combustion the desired pressure in the boiler.

In order that the combustion shall be, as far as possible, complete, the oil supply must be regulated with due reference to the varying steam pressure at the atomizers. The oil governor in Fig. 3 consists of two brass castings *K* and *M*, with a diaphragm *L*; at *R* is a sediment chamber and plug; *Q* connects to oil tank.

As the pressure in the pipe *O* varies, so is the valve operated by the diaphragm *L*, permitting only the desired amount of liquid fuel to flow to the atomizer. The valve is tapped to fit the threaded stem, and can be reached for adjustment by removing the plug *R*.

The forward wheels of the carriage are pivoted close to the hub, as in Fig. 4. *A* is the square axle having a bearing for the spindle *C*, welded on; the wheel revolves on *B*; the alignment of the wheels is preserved by the rod *E* attached to *D*; *C*, *B* and *D* form a single forging. On the right of Fig. 4 is given the more common form of front wheel bearing for vehicles of this class; *H* being the axle and *K K* bearings for the pivot screws



CARRIAGE BODY REMOVED TO SHOW ENGINES AND MACHINERY.

J J; by bringing the bearings *K K* around the hub *I*, the center line through *J J* is brought closer to *L M* and the steering lever is not so sensitive to obstacles on the road. The bearing may be arranged so that the center line through

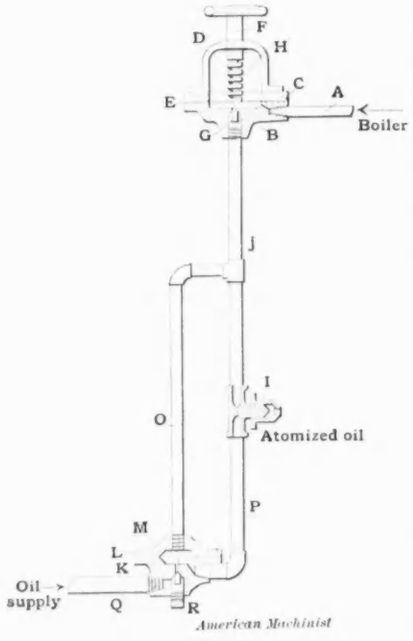


Fig. 3

ARRANGEMENT FOR FEEDING OIL TO BOILER FURNACE.

J J shall not be parallel to diameter of wheel, but shall bisect *L M* at the point where the wheel rests upon the ground. However, the construction on Cross carriage contains few parts, and is thereby less liable to accident than the other form here described.

Between the engines an air pump is fixed (vide Fig. 2) for the purpose of getting up steam; by pumping air into the boiler sufficient pressure is obtained to operate the atomizers until the water is sufficiently heated to become self-operating. The air pump, however, is only used when away from home; at other times a copper ball, 3 inches diameter, is temporarily attached to a tee at *J* (Fig. 3). The ball filled with water and heated by a Bunsen burner will cause the boiler to steam in twelve minutes; afterward the burner is extinguished, the atomizers shut off from boiler, while the ball is disconnected with the tee plugged; when the boiler becomes automatic on admitting steam to atomizers through regulating device. A supply tank is fastened to the wooden body on each side, and holds 15 gallons of oil and water respectively; with crude petroleum the expense is 1 cent a mile.

Providence, R. I.

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A Proposed Link Hanger.

BY FRED E. ROGERS.

A novel form of link suspension has been suggested to the writer, and possibly it may be new and interesting to some of the readers of this paper. Whether it has ever been used is not known.

The well-known ordinary form of link is suspended by a saddle having a projecting stud. This saddle is bolted to the side of the link, and of course the weight of the link and connections is so carried that the tendency is to twist the link over to the side opposite the saddle. On some locomotives the weight of the link and its proportion of the heavy curved eccentric rods carried by the hanger is not less than 150 pounds, and the thrust in certain positions multiplies the strain. The result is that the wear of the hanger, even if thoroughly case-hardened, is comparatively rapid, and when worn the link tips to the side, with a consequent distortion of its functions and a detrimental effect on the other connections.

The double hanger shown in Figs. 1 and 2 has been proposed to overcome the twisting action by making the vertical line through point of support and center of gravity of the link, in the view of Fig. 2, coincide with the middle point of each of the working bearings.

The necessity for the two hangers comes from the inability to place the

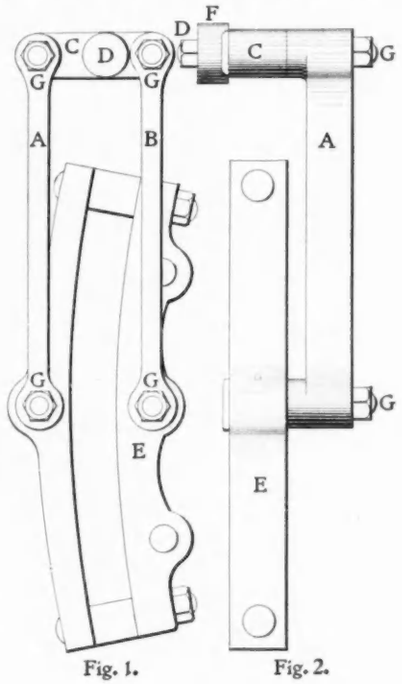


Fig. 1. Fig. 2.

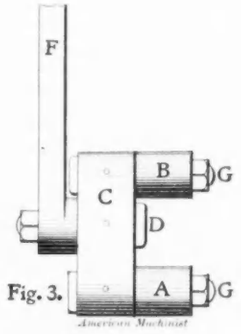


Fig. 3.

A NEW METHOD OF LINK SUSPENSION.

point of suspension in the proper location to effect equalized cut-off with one hanger, but the same result is obtained by means of the parallel motion in combination with the rocking piece *C*. This part has its point of support, *D*, located exactly as the point of suspension of the ordinary link, and the result does not differ in any way.

The pins *G G G G* are tapered fits in the hangers and working fits in the piece *C* and the bars of the link. In the plan view the pin *D* is seen to be a tight fit in the arm of the tumbling shaft *F*, and a working fit in the piece *C*, so that the arrangement is such that all the working parts are so located that the twisting action due to the weight of the link is entirely avoided, though at the expense of a number of extra parts and bearings to be oiled.

Corning, N. Y.

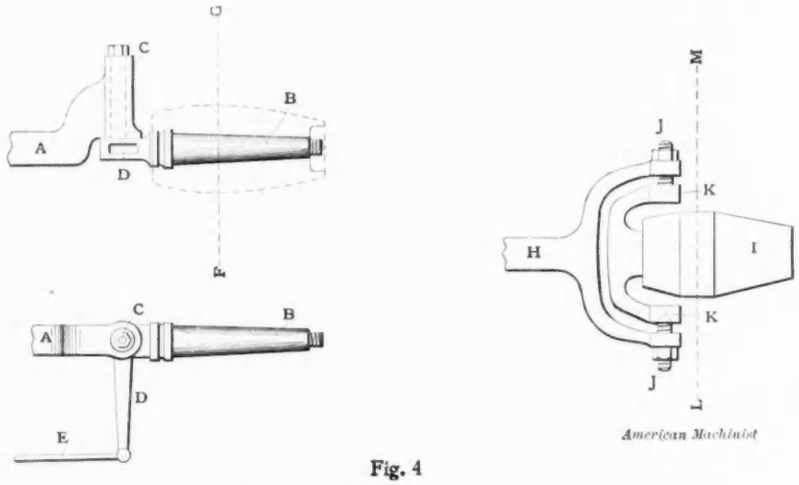


Fig. 4

ARRANGEMENT OF STEERING WHEEL AXLES.

Letters from Practical Men.

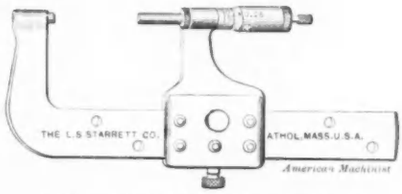
The Starrett Six-Inch Micrometer.

Editor American Machinist:

I wonder if all your readers "caught on" to one of the beauties of the Starrett micrometer shown in the front page advertisement of your issue of September 22.

At first glance this struck me as an impracticable tool—that is, as one which could have the holes in the beam spaced with the necessary accuracy only by the aid of a great amount of labor, if, indeed, this accuracy could be secured at all in regular production. A second glance showed, however, that the difficulties of spacing the holes had been surmounted by as pretty a scheme as one will come across in a good many days' journey.

If you will reproduce the engraving and print it herewith, your readers will see that the sliding head has as many holes for the plug as the beam, and this simple scheme does the business. These holes, both in



STARRETT 6-INCH MICROMETER.

head and beam, are stated to be bushed with hardened bushes and then lapped to fit the plug. If the sliding head had but one hole, the holes in the beam would obviously require to be exactly spaced, exactly in line, exactly parallel axially, and of exactly the same size—a series of exactlies which are formidable enough. Moreover, this instrument, like all other micrometers, will be used most for short measurements, leading eventually to greater wear in the holes near the fixed head. Now, if the sliding head had but one hole, the result of this wear would lead to a lack of correspondence between the hole in the head and those in the outer end of the beam, with corresponding looseness of the plug when in the outer holes.

Now, all of these difficulties are overcome by the use of a separate hole in the sliding head for each hole in the beam. With this construction the head need only be located for each position, and the holes be then lapped until the plug fits—the hole locating itself as it sees fit. The different holes need not be equally spaced, need not be in line, need not be parallel axially, and, the plug being presumably conical, need not even be of the same size, while wear in one hole cannot affect the fit in others. Moreover, if, as I presume, the outer holes of the head belong to the outer holes of the beam, and the inner holes of the former to the inner holes of the latter, there is no excuse for anyone but a blockhead (and blockheads do not often use such tools) to enter the plug wrong, although by putting the holes in the beam on a slightly inclined line the plug could not be entered wrong even by a blockhead. I offer this suggestion to the Starrett Company without charge.

Maybe I haven't caught the correct spirit of the arrangement, but this is the way it looks to me, and if it isn't so it ought to be so. Did you ever see anything neater in your life? I never did.

C. O. GRIFFIN.

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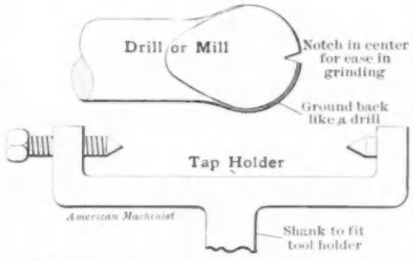
Grooving Taps.

Editor American Machinist:

I have been a constant reader of the "American Machinist" for the past six years, and up to the present have always thought that there was one grave fault about it, viz.: that there was not enough of it. Instead of getting it, as we do where I live (in the center of New South Wales), four copies once a month, I would like to get it four copies a week if possible.

I am only an amateur, but I have to thank the "American Machinist" for many valuable hints. As I have no possible chance of seeing how work is done, I have to trust altogether to reading for my information. I have repaired a great many different machines; in fact, I might almost say from a theodolite to a steam engine. Having to make taps of unusual pitches, I hit upon a simple way of grooving them to form the cutting edges, which needs but little in the shape of tools. In fact, with the lathe alone and about 3 inches of quarter-inch round tool


Drill or Mill
Notch in center for ease in grinding
Ground back like a drill
Tap Holder
American Machinist
Shank to fit tool holder

AN AUSTRALIAN AMATEUR RIG FOR GROOVING TAPS.

steel, I can groove a tap in a very short time. I form the steel into a modified kind of flat drill, something like the sketch, and hold the shank of the tap in the tool-holder of the slide rest, using pieces of sheet metal as packing to bring the tap up to the hight of the lathe centers. This, of course, is a rough method, but I can answer for its doing good work. The tap has, of course, to be shutted round for each cut. If I had many to do, would make a holder (Fig. 2) with set-screw at one end and a fixed center at the other, the shank being made of a size suitable for the tool-holder of the lathe. If the above has not been tried by any of your readers let them just make a drill as per sketch and try for themselves. They will be surprised at the pace at which they can cut out the grooves, and at the nice, smooth grooves turned out. The drill is, of course, held in a drill chuck on the lathe spindle and the tap is fed across the lathe.

I have noticed in some of your back numbers suggestions for binding the "American Machinist." I only wish I could show some of your subscribers my last volume, which I have bound myself from instructions given in "Amateur Work" on bookbinding. Several who saw some of my first attempts persuaded me to exhibit them at one of our pastoral and agricultural shows, which I did; and I received a special first prize for my work, as well as comment from both local papers. So you can see that I not only read, but put my reading to practical use.

Wishing the "American Machinist" all success.

C. BOULTON.

Condobolm, New South Wales.

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Bargains in Labor.

Editor American Machinist:

The incident related by the "Engineering News," and referred to in the editorial in the last issue of the "American Machinist," seems to carry still another lesson besides those already suggested. It will be remembered that in an establishment using considerable steam power, and located directly on the banks of a large river, the exhaust from the engine was a great and constant annoyance, and the "engineer" of the establishment could suggest no better remedy for it than to lay a long pipe and discharge the exhaust at a distant point, this solution of the difficulty being still far from satisfactory. Only when a professional mechanical engineer came along was it suggested that a condensing engine was really the thing required.

Of course the "practical" engineer of the establishment should have known as much as this, and the fact that he did not know it would be unhesitatingly taken by those properly informed as proof that he had not sufficient knowledge of steam to constitute him a competent, reliable or economical engineer. But why was such a man in such a place? He had been hired, or, to state it correctly, his services had been bought by someone. It was the buyer of those services who was really the incompetent man of the establishment. We have altogether too much of this style of incompetence in the management of shops and factories. The importance of knowledge, of as much and as accurate knowledge as possible, concerning the various materials to be purchased is regard-

ed as of the first importance in the man who does the buying; but in the buyer of the labor, the most costly element in most machine production, no such knowledge is insisted upon, or, usually, even thought of. In hiring men we have generally only the bargain counter idea. Lowness of price in men to fill responsible positions is too often the determining factor. We advertise for men, and insist, among other things, that they aim in the dark at the pay they are to get. One man applies with an excellent record and another with no record at all but bidding a quarter of a dollar a day lower, and the chances are more than even that the latter gets the job.

Money not paid out is not necessarily money saved, or we might shut up shop and save it all. The money not paid out to equitably remunerate competent and intelligent service is money lost many times over. This is true in the first hiring of men, and is also true regarding their subsequent advancement. It is of the first importance to have the services of *satisfied* men, to have them know that they are fairly and reasonably treated. As a rule, men know quite accurately what they are worth. No man can be a skilled workman without first knowing what good work is and also knowing when he does it, and he is apt also to know about what it is worth to do it. For various reasons the sellers of labor, especially of the higher grades, often fail to secure full remuneration. How many men there are employed who are paid not what they are worth but what will suffice to hold them, it being well understood that their family or other ties cannot easily be broken, to change their permanent location. Some are so foolish or unfortunate as to become the slaves of a little piece of land or a house. I of course advocate the judicious saving of money. I do not advocate, as is the fashion, the accumulation of money at any sacrifice. The present use of money is often vastly better than the future use of it. The buying of a house in a small town by a wage-earner is not always and necessarily a wise step. The possession of the value of the house in convertible shape leaves the man in a more independent position. There is considerable human nature in the average employer and he should not be tempted overmuch.

But I have run away a little from what I was thinking of at the beginning, which was the necessity of wide general knowledge in the heads of industrial establishments. The knowledge should be of such a character that it will enable its possessor to select competent men for the various positions of minor responsiblity. If, for instance, the head of a concern does not know enough to select a competent engineer, and to be sure that he has such an engineer, that concern is in a bad way. If his method of selecting his assistants is according to the price for which they can be had regardless of qualifications, then his method is about the worst possible. We often see in the advertisements a call for a hustler. I never knew an establishment in most successful swing that was run by a hustler. The knowing of how things should be all around is better than all the hustling. The man to have for the head of a hospital is the best physician you can get.

TECUMSEH SWIFT.

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British and American Pipe Fittings.

Editor American Machinist:

I can sympathize very sincerely with Mr. Tecumseh Swift when he relieves himself on the subject of pipes and pipe fittings. The English idea (so far as I can find evldence of any idea existing about the matter) is that the female thread should be parallel and the male thread a pure parallel or a mixture of taper and parallel, according to the pipe fitter's ideas of the best method of making a joint. The diameter of a thread is a matter on which most makers here are a law unto themselves. In America there is supposed to be a standard "Briggs" system of pipe threads, but judging from an illustration in "Power," which showed a length of 4-inch pipe which had only been holding by two threads, it would appear that proper interchangeability has not yet been secured. Another annoying feature about commercial fittings is that one can never be sure that the threads in an elbow, cross, tee or such like fitting are square with each other.

I have seen a number of men who had previously considered themselves above the average as machinists show to very poor advantage when confronted with a pipe fitting job, while a very moderate man, who was acquainted with the pitfalls and traps of piping, could easily put them to shame. There seem to be the elements of a solution of the question in the "Tight Joint" system, in which the threads are parallel, and a soft metal is forced into the threads by a set-screw, making a joint even if the fit of the threads is very slack. The pipe ends could with this system be faced up true with the thread and a butt joint made, the edges of the pipe bore being also rounded a little.

I remember a steam jet ejector which absolutely refused to work. On inspection it was found that the steam feed entered the nozzle through a sharp cornered elbow. When the elbow was replaced by a bend the ejector at once worked satisfactorily in every way. If the "Tight Joint" method is to be used as a solution it almost seems as if the "Tight Joint" people would have to issue licenses to most makers of valves, cocks, etc., as the threaded parts of these fittings are as unsatisfactory as the other steam fittings. I don't know whether the "Tight Joint" firm make gun-metal fittings as well as malleable iron ones. There is something very attractive to many people here in a well-finished gun-metal fitting, especially on a boiler front or other conspicuous position. The finish of American valves sold over here leaves, in many cases, much to be desired. Many of the flats are filed (and badly filed at that) where they would be milled here, even in quite common work. The threads of the spindles, the nuts, the wedges and the back sides of the disks of "open" or "full" way valves are often simply cast, and, notwithstanding the low first cost, a well-known brass finisher told me that customers who had left them had returned to them, as they had found the "cheapness" more apparent than real, as the English valves had more metal in them, and realized more also as old metal when finally scrapped. It seems rather strange to receive filed articles from America, the home of light and medium milling, especially when we are treated (though not quite as often as formerly) to articles in the semi-technical press about "the unerring accuracy of machinery replacing the uncertain operation of the hand." It may be mentioned that firms like Deurance, of London, and Hopkinson, of Huddersfield, find no difficulty in obtaining twice or three times as much for their valves and cocks as the ordinary run of makers secure. This is owing to the fact that quite a distinct proportion of customers in England do not object to paying for a good thing. The same feature was noticed by, I believe, Mr. Rockwood, an American engineer, who, in trying to compare the relative costs of boiler installations in Great Britain and America, found that the principal anxiety of the purchaser here was not so much about first cost as subsequent satisfactory behavior and low cost of up-keep. Mr. Swift's remarks on "Educating the Boy" and "Small Shop Proprietors," etc., are very suggestive, and at the first opportunity I will give a few of my own present ideas (subject to alteration without notice) on the subjects. It is this feature of elasticity in the treatment of everyday shop subjects which makes the "American Machinist" so popular here with that class who have to make time to read up on technical subjects. One can pick up a great deal of information from it in an easily remembered form, even when the reading has to be done by snatches.

JAMES VOSE.

Manchester, England.

[The above communication seems to suggest the inquiry as to whether the worst instead of the best samples of American pipe fittings do not stray across the water. Elbows which are tapped square are certainly common enough with us, or we could not do the neat jobs

of piping that are seen in our buildings, vast quantities of piping being used, and all apparently absolutely square where they are so required to be. We have to confess, also, that we seldom see valves the hexagon ends of which have not been milled. Some makers of cheap valves finish the ends with the emery wheel, and this work may have been mistaken for filing. It would seem to be proper, in our endeavors to secure permanent trade abroad, to send over in all cases the best specimens of our workmanship, instead of such as justly provoke unfavorable criticism, but it is of course a matter of price largely.—ED.]

▲ ▲ ▲

The Humpage Reducing Gears.

Editor American Machinist:

The shop notes by Mr. Vose in the issue of August 4 bring up the interesting subject of epicyclic trains by the presentation of a description of the Humpage reducing gearing.

The extreme compactness, combined with great range of reduction, of these gears would call for more than passing notice, but the statement that none of the technical institutions to which the model was loaned had ever offered any solution of its action is surprising. Probably this came from indifference rather than from the inability to properly analyze its movements, as the action is no more complicated than others which have been presented at different times.

While the half-tone does not clearly show the exact arrangement of parts, it can be quite safely assumed that the gear A is fixed, while D is keyed to the shaft shown to the left. The epicyclic gears B and C are mounted on a sleeve revolving freely on this shaft, and E is regarded as the driver, mounted on an independent shaft, as shown to the right.

The precise arrangement is novel, but a similar principle, with an added complication, is, I think, shown by Henry T. Brown in "507 Mechanical Movements."

If the movement is as outlined above we have a differential epicyclic train, whose action is easily analyzed, but the analysis will not be given here farther than the simple formula necessary for finding the ratios between the driver and the driven.

In this formula the letters represent the numbers of teeth in the different gears as designated in the half-tone.

$$R = \frac{\frac{A}{E} + 1}{\frac{A}{B}\frac{C}{D} \mathrel{\text{S}} 1}$$

The solution for the model gear shown is as follows:

$$R = \frac{\frac{46}{12} + 1}{\frac{46}{40} \times \frac{16}{34} \mathrel{\text{S}} 1} = \frac{4\frac{5}{6}}{\frac{624}{1360}} = 10.56+,$$

or 10.56 revolutions of E for one of gear D.

This would be about the reduction usually given by the back gears of a 16 or 18 inch engine lathe.

An interesting feature of these gears is that the motion can be reversed without any extra parts by merely changing the proportions. If $\frac{A}{B}\frac{C}{D}$ be less than 1 the movement of D and E will be in the same direction, but if $\frac{A}{B}\frac{C}{D}$ be greater than 1 the rotations of D and E will be opposed.

The possibilities for a great reduction are wonderful, and, as stated by Mr. Vose, only a slight variation in the proportion of the different gears is needed. Thus if C have 33 teeth and D 38 and the others be unchanged, the result is

$$R = \frac{\frac{46}{12} + 1}{\frac{46}{40} \times \frac{33}{38} \mathrel{\text{S}} 1} = \frac{4\frac{5}{6}}{\frac{2}{1520}} = 3673,$$

or 3673 rotations of E to one of D.

Now if the number of teeth in C and D be increased one each the direction of the rotations of E and D will be opposed, as shown:

$$R = \frac{\frac{46}{12} + 1}{\frac{46}{40} \times \frac{34}{39} \mathrel{\text{S}} 1} = \frac{4\frac{5}{6}}{\frac{4}{1560}} = 1885$$

as $\frac{46}{40} \times \frac{34}{39}$ is greater than 1.

The ratio becomes infinity when $A : B = D : C$, as then the denominator of the formula disappears, but practically under these conditions D will have no movement, the epicyclic gears revolving without changing the relative positions of A and D.

FRED. E. ROGERS.

Corning, N. Y.

▲ ▲ ▲

Incorrect Indicator Practice.

Editor American Machinist:

I wish to say for the information of Mr. Tecumseh Swift that there are at least some engineers to my certain knowledge that do not use the method of computing indicator diagrams that he advocates in the issue of September 15, because it is much more trouble, and, as he has ably demonstrated, because it agrees with the ordinary method when taken as a whole. I see no objection whatever to the ordinary plan. No engineer who has any claim to being accurate would base a calculation on anything less than two full diagrams.

I wish to point out a mistake he has made in his article, more especially because it is almost as common as the one he tries to correct, but does not succeed in showing to be wrong. In the first column on page 28 he says: "The pressure against the driving face of the piston at any point of the advancing stroke is measured by a vertical line from the corresponding point on the line *a c b* down to the atmosphere line, and the mean pressure against the driving face of the piston, by the mean vertical hight of *a c b* or the mean of any number of equally distributed vertical ordinates." Now, if that statement is correct, why is it that the mean effective pressure which is determined by it never agrees with the mean pressures given in the tables published in many reference books, based on the following rule: Divide the hyperbolic logarithm of the ratio of expansion, plus 1, by the ratio of expansion, and multiply the quotient by the initial pressure? The superficial student will say that it is because clearance affects the results, and on account of the way in which the steam line falls away, etc., when these are not the causes of discrepancy, except to a very limited extent, in diagrams that are worthy of being called good. The trouble is caused by measuring down to the atmosphere line, as Mr. S. tells us to, when in reality we should measure down to the line of perfect vacuum whenever we want to ascertain the mean pressure acting on the face of a piston to drive it forward, and when this is done the results will very nearly agree with the mean pressures given in the tables, in the case of good diagrams, and only vary to the extent of small fractions in perfect diagrams.

I have demonstrated this as follows: With an initial pressure of 80 pounds by the gage, and 14.7 pounds atmospheric pressure, cutting off at one-quarter stroke, the rule gives 56.488 pounds mean pressure. Taking a diagram with the same data and dividing it into ordinates gave 56.7 pounds pressure. Using a planimeter, according to one method, gave 55.98 pounds and using it according to another method gave 56.2 pounds, while a strict adherence to Mr. Swift's rule gives 42 pounds mean pressure. His rule for determining the mean back pressure is equally deficient, and in order to demonstrate this it is only necessary to attempt to apply both to a diagram from a condensing engine.

When a rule is given us for determining the mean pressure on a piston it should apply equally well to condensing and non-condensing engines, and the same is true for a rule for determining the mean back pressure, for it is in nowise necessary to have one rule for a condensing engine and another for a non-condensing type. Such a rule is as follows: Divide the diagram into ordinates and ascertain their average hight above the vacuum line. The result is the mean forward pressure, or, in other words, the average pressure. To determine the mean back pressure ascertain the average hight of the back pressure line above the vacuum line. When one

is subtracted from the other, the remainder is the mean effective pressure.

W. H. WAKEMAN.

New Haven, Conn.

Editor American Machinist:

I have read the letter of Mr. Wakeman referring to my recent article on indicator practice, and I am much gratified and flattered. Writing is always work to me, and I don't like to feel that my work is all for nothing. The very worst thing that anybody can say about anything that I may write is nothing. If something is said then I know that my work has attracted somebody's attention. It is of course especially gratifying when the word comes from one who is experienced and informed in the precise line referred to. Mr. Wakeman, as we all know, is an engineer, and of course knows much about engines and their concomitants, and should therefore be the proper one to discuss matters relating thereto.

Mr. Wakeman does not approve of my suggestions relating to indicator practice, and I am under the necessity of self-defense. I must call the attention of Mr. Wakeman to the first essential condition of satisfactory controversy, whether in the technical journals or elsewhere, and that is that both fellows shall talk about the same thing. Much irrelevant and unprofitable discussion, so-called, occurs through an ignoring of this condition. The one may not have really comprehended what the other was talking about, or he may wish to place him in a false position, or some other less reprehensible condition may prevail, but the circumstance is not to be admired at the best.

Now, Mr. Wakeman very distinctly does not talk about what I was talking about at all. I must on the present occasion decline to follow into the wilderness whither he would lead me.

The purpose of my article was to show that in the ordinary method of treating indicator diagrams the results obtained are incorrect in two particulars. Except where the diagrams are identical for both ends of the cylinder, which they almost never are, the total work for the alternate strokes is not correctly apportioned, and whether the diagrams are identical or not the distribution of the effective driving force throughout the individual stroke is not correctly represented. I think I showed this very clearly. Mr. Wakeman says that he sees "no objection whatever" to the old way, but offers not a word to disprove my position.

It will be remembered that in my article I had to do with indicator diagrams from a high pressure or non-condensing engine, and that the pressures for both sides of the piston were determined by vertical measurements from the atmosphere line. Mr. Wakeman says that this is all wrong, and that the pressures can only be correctly measured from the line of perfect vacuum. I don't like to shock Mr. Wakeman, but it is a fact that my results would have been precisely the same whether I had measured from the atmosphere line, the vacuum line, a line a foot below the vacuum line, or from any other line parallel to the atmosphere line. From whatever depth the lines of pressure and counterpressure were measured the vertical distance between them, or the effective pressure, would have been the same. I simply used the atmosphere line because it was there. If I had diagrams from a condensing engine their mean effective pressures also could be measured from any line parallel to the atmosphere line, and, for convenience, located below every part of the diagram to be measured. If a planimeter was used the mean effective pressure could and would of course be determined without any reference to any horizontal line. As to the uses of the atmospheric or the vacuum lines for other purposes, it would not be proper to discuss them in connection with my article.

TECUMSEH SWIFT.

▲ ▲ ▲

Indicating the Vacuum of High Pressure Engines.

Editor American Machinist:

When indicating high speed engines it is necessary to make use of very stiff springs in the indicator to reduce the effects of inertia. With single cylinders and high pressures this leads to a very small scale of the card and to uncertainty in locating the absolute vacuum line, and in comparing the cylinder and condenser pressures for the determination of the losses of pressure in the valves and passages.

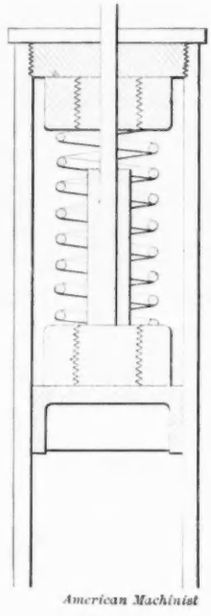

Fig. 1

ARRANGEMENT OF INDICATOR SPRING.

To overcome these difficulties I make use of a limber spring to determine the vacuum realized, and to avoid injury to this spring I fit a sleeve over the indicator piston rod of such length that it will

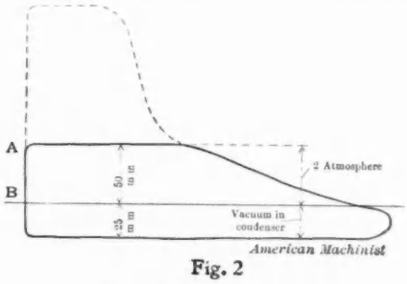

Fig. 2

THE CARD TAKEN.

engage the upper spring collar before the spring is unduly compressed. The arrangement is shown in the sketch, Fig. 1.

Of course the card taken by an indicator so fitted is incomplete, the part represented by the dotted line of Fig. 2 being left out, but the object of indicating the vacuum on an increased scale is realized. The springs thus used have a scale of, say, 25 m. m. per atmosphere.

By comparing cards thus taken from the cylinder condenser, and the connecting pipes, I have ascertained that velocities of 40 meters per second are permissible in the pipes and valves without appreciable loss of pressure. H. BOLLINCKX.

Brussels, Belgium.

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That Elastic Coupling—Tangential and Other Pulls.

Editor American Machinist:

In your issue of September 1 Morris Fulton advises making the pull on the links of the insulating coupling tangential by having one set of arms longer than the other.

THE CHANGE IN ANGLE OF PULL.

The pull or tension in a link depends upon the perpendicular distance from the center of shaft to the line of centers of

the link, and bears no relation to the relative length of the arms.

ERNEST A. TURNER.

Cornell University.

Editor American Machinist:

It seems to be necessary for me to say a word or two in reply to the above communication, which has been brought to my notice. In the issue of September 1, above referred to, I merely suggested changing the angle of the pulling rods (or straps) from the dotted lines to the full lines of the present sketch, and, for transmitting equal power to the driven shaft, this evidently reduced the pull upon the rods. This change of angle was effected by a change of the relative length of the arms, so that the relative length of the arms and the pull on the rods were closely related and interdependent. I did not, however, in my communication, insist upon the relative length of the arms as the essential feature, as Mr. Turner implies, but upon the tangential pull thereby secured.

MORRIS FULTON.

Philadelphia.

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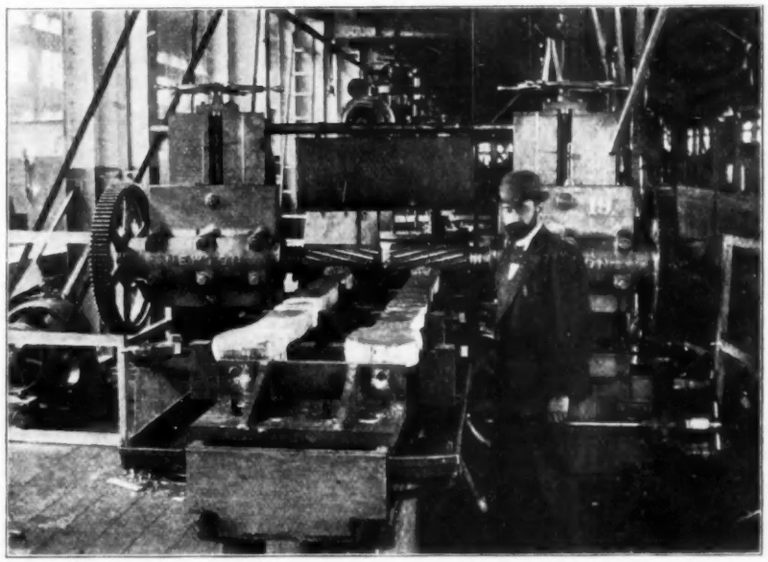
A Russian Heavy Milling Cutter.

The Newton Machine Tool Works send us a photograph from which the accompanying half-tone has been made, which represents a heavy milling operation at the locomotive works of the Sormovo Company at Nijni-Novgorood, Russia.

The cutters are the design of the general foreman of the works, Mr. A. Karagopoloff, who had considerable trouble with solid cutters on account of rough handling by unskilled men, and these cutters were designed to overcome the difficulty. They are made with solid steel centers, having grooves milled in them, into which small pieces of self-hardening steel, 1½ inch long, ⅜ inch wide and 1¼ inch deep, are inserted. These short sections are inserted in the slots and the body of the cutter is then calked to hold them in place.

The work being done is the milling of two very roughly forged rods, the depth of stock taken off being about ¾ inch, while the feed is at the rate of ⅞ inch per minute.



A RUSSIAN MILLING CUTTER.

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What Is the Efficiency of an Air Compressor?

BY FRANK RICHARDS.

The following question has been brought to my notice:

"Assuming that there is no mechanical friction to an air compressor or blowing engine, and that the machine is compressing air to a pressure of one atmosphere by gage, or two atmospheres absolute, what is the possible efficiency of the machine if it does not compress the air gradually? The writer has in mind a rotary pressure blower, which should not properly be used for an air compressor; but, assuming a blower to be frictionless and to have no leakage, and, disregarding the loss by radiation of heat, what would be the possible efficiency of the blower in compressing to one atmosphere?"

The question is one which might very naturally shape itself in the mind of a good mechanic who is just beginning to look into the operation of air compression. We have to assume that the air is compressed for some power transmission purpose, and it is therefore a question of the loss of power in the operation of compression, or a question of the power cost of compression. We cannot, as suggested, disregard or ignore the radiation of heat, as the question of efficiency depends entirely upon temperature conditions. Leaving out all consideration of friction and leakage, the entire range of possible efficiency in air compression lies between the compression of the air at initial and constant temperature, or isothermally, and its compression without abstraction of heat during the compression, or adiabatically.

In compressing air isothermally in a cylinder traversed by a piston, the mean effective pressure or resistance for the stroke when compressing to two atmospheres, or, say, 15 pounds gage, and including not only the compression of the air, but its expulsion or delivery into the pipes, is 10.33 pounds. For the same operation, if conducted adiabatically, or without any cooling of the air during the operation of compression, the mean effective pressure is 11.51 pounds. As isothermal compression represents perfect efficiency, the relative cost of adiabatic compression is shown by dividing the one m. e. p. by the other; thus: $11.51 \div 10.33 = 1.114$. The power cost of compressing air to 15 pounds gage cannot, therefore, be made to rise more than 12 per cent. above perfect efficiency, so far as the air itself is concerned. The other losses in compression are those of friction and leakage, which can only be ascertained by actual tests, and in the above question we are not invited to look into them. The relative efficiency of a rotary blower as compared with a reciprocating piston machine is all comprised in their differences of friction and leakage, as the air will require the same power for its compression by either means.

The suggestion as to compressing the air gradually is the suggestion of a still rather widely held fallacy. By gradually is rather meant slowly, and the assumption is that if air is compressed slowly enough it will not be heated as much by compression, if, indeed, it is heated at all. The air will be heated precisely the same whether compressed quickly or slowly. If it remains cooler under sufficiently slow compression it is only because it is actually cooled, or gives off heat to the walls of the cylinder, or whatever it may be in contact with during the compression. There is no saving of power by slow compression over rapid compression except by some cooling of the air that may ensue by the equivalent heating of the cylinder and piston.

The loss by radiation of heat is not a loss but a gain, or a saving of power, if it occurs during compression, but is a distinct loss of power after compression and delivery of the air is completed, on account of the consequent reduction of the volume or pressure of the then available compressed air. If the air can be applied to the use for which it is intended before it loses its heat of compression, or when it has lost only a portion of that

heat, so much power is saved. For this reason it is not usually satisfactory to consider the efficiency or economy of any given case of air compression without at the same time considering the conditions under which the air is subsequently employed.

If air could be compressed isothermally and then completely re-expanded isothermally, while exerting its full expansive force against a piston, no loss of power would be sustained at either end of the operation so far as the action of the air was concerned. This is, however, an impossible condition, either in the compression or in the re-expansion of the air. In the case before us, when compressing air from one to two atmospheres the m. e. p. for adiabatic compression may be taken to be the actual m. e. p., as, when compressing at the speed that would be commercially possible, there would be no appreciable cooling of the air during the operation. Some hydraulic air compressors, in which the air that is being compressed is intimately mixed with the water, do compress the air nearly isothermally, but none of the usual mechanical compressors do this. In compressors working to considerably higher pressures the familiar device is employed of performing the total compression in stages, or by two or more successive compressions, with a cooling of the air between each two successive compressions, and it is found well worth while to do this, especially where considerable quantities of air are handled. Much compressed air service is still on so small a scale as to make the arrangement of debatable value in those cases.

In the compression of air the comparative rates of efficiency seem to lie entirely between perfectly isothermal compression on one side and perfectly adiabatic compression on the other. In the subsequent use of the compressed air adiabatic and isothermal re-expansion should also be the limits of the range of possible efficiency; but there is here an opportunity for a still lower rate of efficiency by the use of the air without any expansion except after release. It is not worth while to show this in connection with a pressure of 15 pounds; but with a pressure of six atmospheres, or, say, 75 pounds gage, a common working pressure, it is worth while to note the range of theoretical efficiency. We have to note both the volume of air used and the m. e. p. developed in its use. With air at 75 pounds gage, following the piston at full pressure for the entire stroke, we have a volume 1 and a m. e. p. of 75 pounds. With air at the same pressure cut-off at .276 of the stroke and expanding adiabatically to atmospheric pressure at the end of the stroke, the m. e. p. should be 35.23 pounds. With the same air cut-off at .1639 of the stroke and, if it were possible, expanding isothermally to atmospheric pressure at the end of the stroke, the m. e. p. would be 26.65 pounds. Here by dead pressure we have 75 pounds m. e. p. per volume 1: with adiabatic expansion we have $\frac{1}{.276} \times 35.23 = 127.39$ pounds per volume 1, and with isothermal expansion we should have $\frac{1}{.1639} \times 26.65 = 162.56$ pounds per volume 1. Isothermal expansion to atmospheric pressure being 1., the standard of perfect efficiency, we have for adiabatic expansion: $127.39 \div 162.56 = .7836$, and for dead pressure without expansion: $75 \div 162.56 = .4613$.

In the compression of air in the usual way, by a reciprocating piston traversing a cylinder, it is of course desirable to have the clearance as small as possible so that as much of the compressed air may be delivered as possible, but the matter of clearance has little bearing upon the efficiency of the compression, as the re-expanding air gives back the power on the return stroke. But in the subsequent use of the air the matter of clearance is one of great importance, as it always involves loss of power. Where the air is used without expansion the filling of the clearance spaces is an absolute and unmitigated loss, and even where the air is properly expanded in use, only a small percentage is recovered from the air in the clearance.

While considerable attention has been given to securing the best economy in the compression of air, and with quite appreciable results, little indeed has been done toward the economical employment of the air after compression, although in the latter there are much greater possibilities of loss, or of saving, involved than in the former.

▲ ▲ ▲

Fixtures for Making Worm Gear Wheel Blanks.

The accompanying illustrations are from working drawings of part of an outfit recently furnished by the Bullard Machine Tool Company for manufacturing worm gear wheels for the training mechanism of naval gun mounts. These are required in such quantities as to justify their reduction to a strictly manufacturing basis, and it was decided to make them by turret methods.

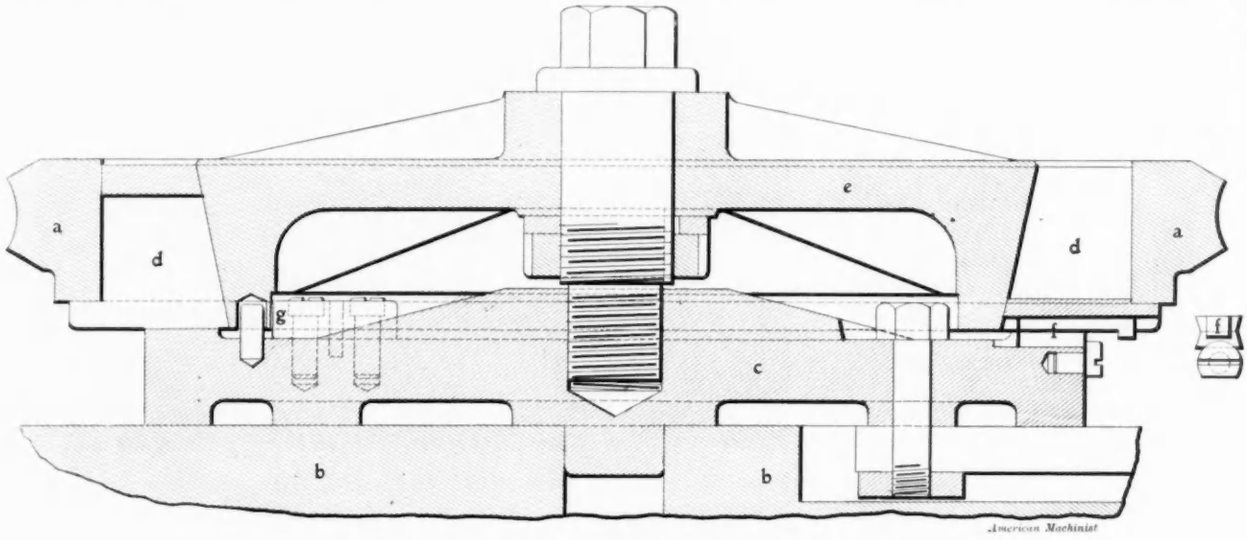

FIG. 1.—FIXTURE FOR CHUCKING WORM GEAR BLANKS.

The machine decided on to do the work was one of the 30-inch turret mills of the regular Bullard pattern, and the engravings show such of the tools provided as are of special interest.

Fig. 1 shows the method of chucking the gear wheels, in which the rim is separate from the spider. The rim will be seen in cross section at *a*. At *b* is the T-slotted table of the mill, on which is mounted the false table *c*. This false

tables carries an expansible chucking ring *d*, which is turned to fit the gear blanks and bored conical, as shown. It is also split nearly in two at six places, the cuts being alternately from opposite sides in the usual way. The section of the ring is through two of these cuts, the one at the right side being from above and the one at the left from below. A conical expander *e* serves to expand the ring *d* by means of the central stud, the collar on the stud serving also to withdraw the expander and loosen the work. To insure this loosening, however, the cut ring is held down to the false table by double dovetailed pieces, one of which is shown at *f*, and which prevent the ring from lifting with the expander, while permitting free expansion. True centering of the expander is insured by three pieces, of which one is shown at *g*, which are turned to fit a bored seat on the inside surface of the expander. It will of course be understood that the gear ring casting comes to the turret mill with its inside and bottom surfaces already finished, as it is by these that the casting is located in the mill.

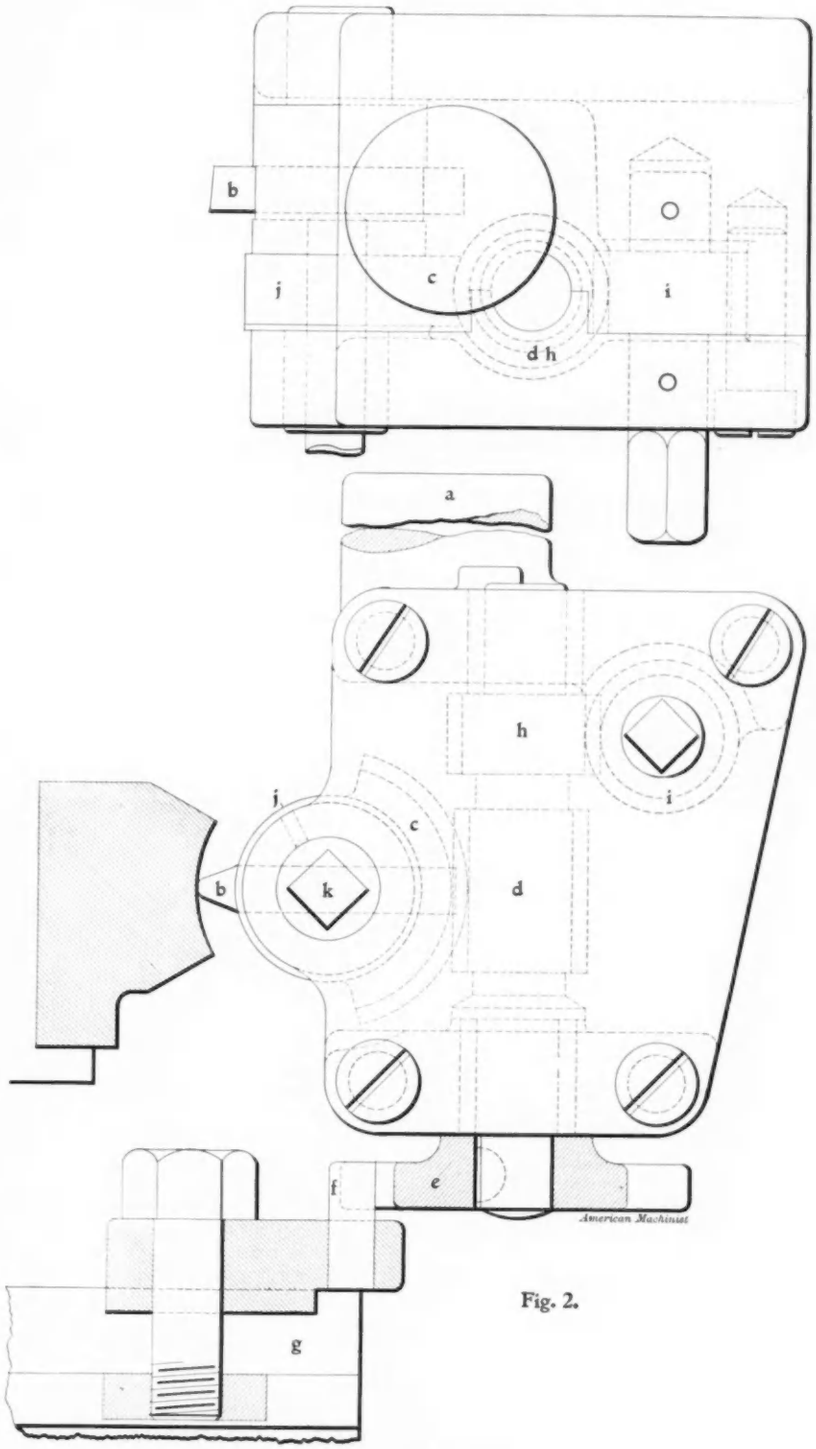

Fig. 2.

RIM TURNING TOOL.

The successive tools for the various cuts do not call for special mention, except the one for turning the outside concave face, which obviously requires something out of the usual order. The tool furnished for this is shown in Fig. 2. The shank by which it is inserted in the turret is seen broken off at *a*. To the shank is attached a box structure carrying the tool *b*. This tool is mounted on a stiff shaft on which is a worm sector *c* operated by a worm *d*. This worm has at its lower end a star *e*, which is engaged by a pin *f* secured to a slot in the mill table, seen at *g*, and so located that when the turret is revolved to bring this tool into action the star shall take its proper place for the pin to engage it. The action of this mechanism is obviously to cause the end of the tool to describe an arc which is the true profile of the desired worm gear face.

Of course the tool must be returned to its place after making its cut, and to enable this to be done quickly a quick action pair of spiral gears *h i* is provided. A small crank is placed on the squared end of the shaft of *i*, when the return of the tool is quickly made by hand. The hub *j* of the worm sector *c* is finished to a defined radius of 1 inch, and by the application of a suitable gage the tool is quickly set to the proper radius, either initially or after grinding. The tool is held in position by a set-screw through the center of its shaft, the head of which is seen at *k*.

▲ ▲ ▲

A story comes to us from Chicago of the saving of the lives of a woman and two children by a monkey-wrench. A house was on fire on the line of one of the elevated railroads and the inmates were asleep. The engineer threw a monkey-wrench through the window and awakened them just in time to barely escape. There are many mechanics who firmly believe that the monkey-wrench is a relic of barbarism and that nothing but solid wrenches should be used. Such men will of course claim that a solid wrench would have served in this case at least as well.

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It is announced that a feature of the coming Mechanics' Fair, which opens in Boston October 10, will be a prize competition of designs for artisans' homes, and it is thought that some valuable ideas along this line will be brought out by it.

AMERICAN MACHINIST

Published Thursdays by

American Machinist Publishing Co.,

256 Broadway, New York.
JOHN A. HILL, President and Treasurer.
C. A. HANSMANN, Sec'y.

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Space in advertising pages only is for sale.
We invite correspondence on subjects pertaining to machinery.
Name and address must always be given, though not necessarily published.
Communications for or relating to the reading columns should be addressed to the Editor. All business communications should be addressed to the Company.
Subscribers can have their mailing address changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrappers denotes week with which subscription expires.

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An Engineer's Account of the Sinking of the Merrimac.

Many articles have appeared in many papers and in many lands entitled "The Sinking of the Merrimac," yet the one we publish elsewhere in this issue is unique. It tells the story from a new standpoint and gives in detail what happened in the engine room.

The writer of the article, who was Chief Engineer of the vessel, had himself intended to go in with her and had made all his preparations with that end in view, but at the last moment was held back by order of the Admiral commanding for some reason to him unknown.

We need not here attempt to characterize or to put in words the admiration we feel for these men of the engineer force who gladly and eagerly undertook for their country a work which must have seemed to them to offer almost no chance of aught else but violent death with immortal glory.

The glory is theirs, and we now say simply that all that has been said in praise of Hobson belongs equally to these men of the engineer force, who braved all the common dangers of the expedition besides others peculiar to their position alone. Hobson is entitled to all the praise he has received, but these men, Crank, Phillips and Kelly, are entitled to their full share, which is far more than they have received or can expect to receive in the public prints. Hobson's features have been made familiar to the world; we give photographs of Crank and Phillips, and regret we have so far been unable to get a photograph of Kelly also.

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Positions Wanted and Help Wanted.

We wish to call particular attention to what is said in the new sub-heading of our department of "Wanted" advertisements. There can perhaps be no more useful work for us than that of bringing employers and mechanics together when the one is looking for men or the other for places, but in carrying on this work some difficulties have appeared which, with a little care, are avoidable.

Cases have occurred in which men answering anonymous advertisements of employers have had their letters forwarded by us to their own employers, and vice versa, with very embarrassing results in some cases.

Once in a while a man wishing to avoid such a possibility asks us to return his letter if the to him unknown advertiser is a certain man—naming his present or some past employer. Of course we cannot do that, because such return would be equivalent to information as to the identity of the advertiser, which information we have no right to give. For the protection of both sides, therefore, and in order that anyone who feels disposed to investigate the merits of any advertisement for help or for a position may do so without danger of embarrassing consequences, we will, upon request, withhold from any specified person or persons any letter sent in answer to an advertisement. But we will not return such letters to the writers. If we do not forward them we will destroy them. For this reason, and other good reasons as well, no testimonials or other original papers of value should be inclosed in such letters. Copies will do as well, if indeed it is not better usually to wait until the identity of one's correspondent is known, or there is a direct request for them, before sending such papers.

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While it is true that our navy has won additional renown during the Spanish war, it will not do to ignore plain facts regarding it. Some of these facts are set forth in another column by one who is well informed on the subject of which he writes. We commend these facts to the attention to those interested. It seems to us they might well form a proper subject of investigation by Congress if such investigation could be conducted by a committee which could include in its membership or could secure the co-operation of an unbiased expert.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(93) G. B., Jr., writes: I would like to ask which is the most effectual, a surface of cast iron and chilled iron running together or two chilled iron surfaces? A.—We do not know that this question can be answered in general terms. We think what would be best to use in a given case would depend upon the particular conditions of that case, and that either arrangement will be durable if properly fitted and lubricated and with ample bearing surface for the work to be done.

(94) J. A. T. asks: Is it necessary—and if so, why—to cut off from ⅛ inch to ⅜ inch of the point of a rock drill at every third sharpening? The rock is very hard and the drills come back to the blacksmith often with the corners worn off. A.—It is only "necessary" because it is expedient to do so. Drills used in hard rock have about as severe duty as steel ever encounters. No steel can be heated and worked and tempered over and over again by even the most careful blacksmith without deterioration, and the cutting off of the small amount suggested is no more than would be proper to keep the cutting end in good condition.

(95) C. A. K., Beloit, Wis., asks for the size and number of battery plates required for a 30 ampere hour cell. A.—We assume that this inquiry relates to secondary or storage batteries. If so, the size of the plates will depend, in part, upon the rate at which the cell is to be discharged, and also upon its construction. For the ordinary lead plate cell 1 square foot of surface of positive plate, or 2 feet for positive and negative combined, will deliver about 7 amperes for ten hours, equal to 70 ampere hours. The same size plates, if forced up to a discharge rate of 15 amperes, will only keep it up for three hours, thus reducing the ampere hours to 45. The first named is a fair rate of discharge, and on this basis the total plate surface should be at the rate of 1 square foot for about 35 ampere hours capacity.

(96) Vermont writes: I came into possession recently of a book entitled "American Agriculturist Year Book," and in this I found the following rule for determining the horse power of an engine: "Multiply the diameter of the cylinder in inches by itself—in other words square the diameter of cylinder in inches and divide by four." Regarding this rule the book says it "will prove correct for all ordinary engines, but there may be a very slight variation in the case of an extra long or extra short stroke." I would like to know if there is any basis for such a rule as this, or if it is anywhere near a close approximation? A.—The rule is absolutely worthless. It not only ignores the influence of length of stroke, but also of speed and steam pressure. Such a rule might occasionally hit an agricultural engine correctly, but would do so only by accident.

(97) H. L. J., Memphis, Tenn., says: In adjusting the admission valves on a Corliss engine, which showed on cards a nicely rounded corner—not too round—at *A*, its eccentric was moved ahead, giving more lead and therefore a perfectly square corner; but as this gives a higher terminal pressure at *B*, and there was already 2 pounds back pressure, I have doubts whether or not anything was gained. A.—H. L. J. says *A* is a nice

round corner—"not too round"—in which case the valves should remain as they were. He has moved the eccentric to increase the lead, and gets a square corner, which should be some gain, but as the terminal pressure has been increased it may be doubtful economy. It would be a good idea, now the eccentric has been moved, to shorten the exhaust valve rods, which would give an earlier release and less compression. But the use of the indicator and planimeter would be the most satisfactory way to settle the question.

(98) C. H. G., Milwaukee, Wis., asks: (1) Can aluminum be used for the points of the contact breakers of electric bells? A.—We are not aware that it has been tried, but should not expect it to succeed. Apart from the question of oxidation, we should expect the low melting point of aluminum would lead to large sparks and early destruction. (2) Can benzine be used in place of gasoline in an explosive engine? A.—Not without the use of heat to assist vaporization. Benzine and gasoline differ in gravity, the former being about 58 or 60 degrees, while for gasoline engines the gravity of the fluid should not be lower than 68 degrees, and 74 is much better. There is a class of engines, more largely used in Europe than here, which employ the heat of the exhaust to vaporize the oil, and use benzine. Of this class are the Preistman and the Hornsby-Akroyd. (3) Why in porcupine boilers are the pipes closed up in the forge instead of using a threaded cap? A.—We presume to insure against leaks and corrosion of the joints. (4) Would a cast iron dome secured by screws and gaskets be practicable on steam boilers? A.—Cast iron domes are frequently used on small boilers—up to, say, 20 horse-power. They should, however, be secured by rivets and calking. (5) Would there be any danger in putting a closed piece of 5 or 6 inch pipe containing water in a stove and raising a high pressure in it if the water line were kept above the fire? A.—Decidedly yes, unless you have it fitted with safety valve and pressure gage. The position of the water line would have little to do with it. Do not try it if you value your life or property.

(99) M. A. G., Schenectady, N. Y., writes: I was quite interested in your article on Carborundum in issue of August 11, and would be pleased to have you explain the phrase "Its hardness lies somewhere between 9 and 10 degrees." What is the "unit" of hardness? Also the phrase "Dried and graded from 15 minute powder to No. 8"? If the chemical symbol has been determined will you give me that also? A.—The scale of hardness referred to is an arbitrary, though a generally accepted one, in which the diamond, being the hardest known substance, is 10, saphhire 9, topaz 8, quartz 7, and talc 1. Recent investigations at Johns Hopkins University indicate that the difference between 9 and 10 of this scale is fully as great as between 1 and 9, which shows the arbitrary nature of the scale, and also that the expression "between 9 and 10" is not very precise or definite, but it is probably the best that can at present be given. The numbered grades of carborundum indicate the number of meshes to the linear inch of the screen through which they will pass, No. 8 being the coarsest and No. 220 the finest. The finest powders (not numbered) are obtained by stirring up ungraded powder in water and then allowing it to settle for a definite length of time, after which the upper portion of the liquid is carefully drawn off and the powder, which then settles from this liquid that is drawn off is called "6-minute," "10-minute" or "30-minute" powder, according to the time allowed for settling of the coarser particles before the upper portion of the water is drawn off. The chemical symbol for pure carborundum is SiC. The commercial article contains slight traces of other substances, but they are of no importance.

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Technical Publications.

BICYCLE REPAIRING. By S. D. V. Burr. Published by David Williams & Co., New York.

The fourth edition of this work has appeared and has been revised and enlarged. It was a good book for the bicycle repairer before and is a better one now—gives numerous illustrations of tools and appliances suitable to the work and plain directions for doing it. 208 pages 6 by 9 inches; cloth, $1.

We have received from the Philadelphia Commercial Museum a report on American trade with India, which country the author of the report considers a promising one for exploitation by American manufacturers. The report gives a sketch of the resources, industries and railway facilities of the country, together with an account of the foreign trade of the country and the American share therein, the shipping facilities between the United States and India, business methods and banking facilities. Appended to the report is a commercial directory of the cities of Calcutta, Madras and Bombay.

CATECHISM OF THE STEAM PLANT. By F. F. Hemenway. 128 3¼x6-inch pages, with 22 illustrations and 5 tables. Press of Locomotive Engineering. Price, 50 cents.

This little book, in the question and answer style, contains just the kind of information that young engineers of steam plants—and old ones too, for that matter—need and usually succeed in picking up only in scraps, "here a little and there a little." It is entirely free from the claptrap which encumbers so many books aiming to cover the same field, and is a painstaking and successful attempt to supply sound and correct information. To many an engineer it will act as a foundation stone on which to lay a large store of knowledge. The volume concludes with a chapter on decimal fractions and tables of the properties of steam, hyperbolic logarithms, etc.

PAINTING TO PREVENT CORROSION. By A. H. Sabin. 80 3½x6 inch pages with numerous illustrations. Edward Smith & Co.

This publication is primarily in the interest of the durable metal coating of the publishers. It is, however, much more than a trade circular, containing as it does full specifications for the painting of structural iron work as well as a general discussion of the subject, the importance of which is becoming generally recognized by engineers. A number of illustrations of corroded iron work are given, which powerfully enforce the necessity for adequate protection.

THERMODYNAMICS OF THE STEAM ENGINE AND OTHER HEAT ENGINES. By Cecil H. Peabody. Fourth edition, rewritten and reset. 522 6x9 inch pages, with 97 illustrations. Wiley & Sons. Price, $5.

Like all books on the intricate subject of thermodynamics, this one is highly mathematical and beyond the reading capacity of anyone who is unable to handle mathematical processes of an advanced character.

The work has, however, a greater practical bearing than many of its class, through the collection of the data of a large number of engine tests and the application of the analysis to them. Nearly one-half of the book is in fact made up of such tests, with studies growing out of them. Of studies of this kind the book contains more than probably any other.

HANDBOOK OF CORLISS STEAM ENGINES. By F. W. Shillitto. 137 4¾x6¾ inch pages, with 69 illustrations. The American Industrial Publishing Company. Price $1.

This book is intended for the use of those who erect and have charge of Corliss engines. It begins with the preparation of the foundations and proceeds in regular order through the placing and squaring of the frame to the adjustment of the valve gear and the starting of the engine. The later chapters are devoted to illustrated accounts of the leading American makes of Corliss engines, with their principal peculiarities of construction.

The book should prove a useful one to any erector or operator of Corliss engines. It is plainly and clearly written and the illustrations are well chosen. It is not to be expected that all readers will agree with the author on all of the many steps to be followed in erecting an engine, but those who differ most will find profit in reading of others' views and methods.

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Personal.

Mr. E. P. Bullard, of the Bridgeport, Conn., Machine Tool Works, has gone to Europe on a business trip.

Mr. Griffiths, of C. W. Burton, Griffiths & Co., London, is here and will buy the machinery for the "Helicoid" lock-nut referred to some time ago.

Mr. Seaton M. Scott, consulting engineer, has moved from 123 Liberty street to his new office, 11 Broadway, New York city.

Mr. A. T. Bruegel, who has been an instructor in the department of machine design of Cornell University for several years, has accepted an important position at Pratt Institute, Brooklyn, where he has charge of the work in drawing and machine design.

Mr. E. H. Putnam, vice-president of the American Foundrymen's Association for the Southern States, having resigned his position, owing to the fact of his removing to another part of the coun-

try, the executive board has elected Mr. J. Bowron, vice-president of the Tennessee Coal, Iron & R. R. Co., Birmingham, Ala., to the vacancy.

Mr. Thomas Hall has resigned his instructorship at Cornell University to become superintendent of the Mansfield Machine Works, at Mansfield, Ohio.

Prof. Harvey D. Williams, of Sibley College, Cornell University, who was absent on leave during the year 1897-98, has decided not to return to the University, and is now engaged in business at Stamford, Conn.

Mr. George H. Shepard, assistant engineer, U. S. N. (retired), succeeds Mr. Hall as instructor in machine design at Sibley College, Cornell University. Mr. Shepard was appointed naval cadet in 1887, was assigned to the engineering division in 1890, and completed the four years' course at the Naval Academy in 1891. He completed the six years' course in 1893, when he was commissioned assistant engineer. He was retired for slight physical disability January 8, 1898, but was ordered into active service May 3 of this year, and served at the Naval Station, Key West, Florida, until August 26. While in the active service Mr. Shepard served two years aboard the Atlanta, three years on the Columbia, and was at the Brooklyn and Mare Island Navy Yards for shorter periods. Mr. Shepard will conduct the work of the junior class in steam machinery, and will also give instruction in the drafting room to the senior classes in mechanical engineering.

Mr. Dexter S. Kimball succeeds Professor Williams as assistant professor of machine design at Sibley College, Cornell University. He will have direct charge of the junior work in kinematics and drawing, and will also conduct the senior courses in design, designated as machinery and mill work, as distinguished from steam engineering design. Professor Kimball was born at St. John, New Brunswick, and received his early education in that province. He served an apprenticeship as machinist at Port Gamble, Washington, and went to the Union Iron Works, San Francisco, as a machinist in 1887. He remained there until 1893, when he entered Stamford University, from which institution he was graduated in 1896, and returned to the designing department of the Union Iron Works. He accepted a position at the Anaconda Copper Mines, Montana, in the spring of the present year, from which he comes to Cornell.

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Obituary.

Enoch Page died at Scranton, Pa., September 23, sixty-two years old. Mr. Page was born in Chatham, N. Y., and in his youth was associated with his father and six brothers in a foundry at Albany, N. Y. He went to Scranton more than thirty years ago as superintendent of the foundry of the D., L. & W. shops, which position he held until his death. He was for ten years chief of the city fire department.

Charles E. Moore, a machinist of Boston and senior member of an elevator building firm, died at Newton Highlands, Mass., September 24, sixty-five years old.

Emil Clevez, born in France sixty-four years ago, died at Northampton, Mass., September 17, having lived in that city forty years. He had been foreman blacksmith many years in shops in that city or vicinity.

Benjamin Fox, the oldest iron and brass founder of New York city, died September 23, seventy-four years old. Mr. Fox came to this city from England in 1847, and started business in a small way, being steadily successful and the business constantly growing. His works were always personally conducted, and it was believed by his men that there was no job in the shop that he could not do. He was compelled to give up his constant and punctual attendance at the foundry only a short time before his death.

William S. Burroughs, of St. Louis, a mechanical genius and inventor, died at Citronelle, Ala., September 16. He was born in Michigan in 1851, had a meager education, no early mechanical training, and for many years was in poverty. While employed in a bank he thought of inventing an adding machine, and the purpose grew and clung to him for life. He went to St. Louis when thirty years old, and was employed in a woodworking machine shop. The first working model of the adding machine was completed four years later and the first merchantable machine was sold in 1892. The right for Europe was sold last year for $200,000. Mr. Burroughs received in 1896 from the Franklin Institute the John Scott medal for his invention.

Hannibal H. Houghton died at Worcester, Mass., September 21, seventy-one years old. Mr. Houghton was born at Paris, Me., was educated in the village school and early began his mechanical career in the shop of his father, who was a machinist and gunsmith. When sixteen years old he went to Boston and helped to build the iron fence which used to inclose the Common. He worked two years more for his father and bought his time for $220 in gold, the bond stipulating that if in the two years to his majority he entered a theater the contract should be void. Mr. Houghton went to work in Worcester before he was of age. He invented the rough surface feed for sewing machines, subsequently adopted by the Singer Company. He also invented and made the first envelope-making machine. He became senior partner of the firm of Houghton & Thayer, for many years one of the most important and prosperous businesses of Worcester. Mr. Houghton retired from business during the civil war, having already acquired considerable property.

William F. Carter died at Chelmsford, Mass., September 21, eighty-eight years old. He was employed forty-four years in the machine shops of the Lawrence corporation, Lowell, and for sixteen years had charge of the motive power.

John Cather died at Salt Lake City September 21, sixty-eight years old. Mr. Cather was born in Ireland, learned the machinist trade in this country, and established a foundry and machine shop at Shenandoah, Pa., in the early 60's, which he conducted successfully for about twenty-five years, when he sold out to his son.

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Inquiries for Machinery.

Those who make or may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiries as follows:

68—For machinery used in the manufacture of crude starch.

69—For makers of the Van Hagen boring tool.

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A Trial of the Eight Hour Day in England.

Short Brothers, a prominent firm of shipbuilders on the Wear, in Sunderland, England, who have been trying the eight-hour system in their works for the last seven years, have just issued a report, in which they declare that the result of their experiment has been very satisfactory. They profess themselves convinced that, under this plan, the men do not lose so much time, but really work more hours than they did seven years ago under the old system. The firm have found that instead of the production being less from the apparently shorter hours of work it has, on the contrary, gradually increased since 1891. They took up the system in the belief that they could get the same amount of work out of their men by a better method. Of the men working on time wages 15 or 20 per cent. lost the first quarter of the day, while the piece men scarcely ever started before 8:30 under the old method. The men started at 6 o'clock, stopped at 8 for half an hour for breakfast, had another interval of an hour at noon, and the day's work was finished at 5. The conditions were such that many workmen were physically incapable of enduring the long hours. It was then quite common for a man, with 24s. a week, to lose, on an average, three quarters per week, simply because he was unable to rise every morning at 6 o'clock and work full time. From 15 to 20 per cent. of the men never started work till

after the first quarter had been lost. Under the forty-eight hours' system the men start—after breakfast—at 7:30, and go with only one break until 5 o'clock, and they are able to do more work this way than under the old system, and at the same time more work is got out of the machines, the results being an increased output and a decreased cost. Under the fifty-three hours' system the men did not average anything like eight hours a day—indeed, some of them did not average five hours, owing to the time they lost. The men, as has been said, work better and longer under the forty-eight hours' system than under the other. The report has attracted great attention among British shipbuilders and other employers of labor, with whom the "eight hours day" has long been a burning question.

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The Elwood Ivins Tube Company, Philadelphia, is, it is stated, making a steel tube the surface of which is covered outside or inside, or when required on both sides, with a thin, seamless tube of aluminum, which is drawn in place. This compound tube, while it has the strength of steel tubing, has all the other advantages of aluminum, and it is thought will prove highly useful for many purposes.

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Commercial Review.

NEW YORK, Saturday Evening, Oct. 1.

THE MACHINE TOOL MARKET.

To say that the demand for metal-working machinery is not all that has been expected is not to say that it is poor. Sellers have strained their expectations of this fall's trade to such a high pitch that they are disappointed when the improvement in business is found to be slow. With many of them the month of September amounted to about the same as that of August, but the leaning seemed to be toward betterment and more strongly marked increases reported by other concerns tend to swell the average.

Some old buyers of machine tools are now entering the market with less constraint than hitherto, and placing good sized orders. Typewriter manufacturers are among those from whom orders are looked for. One in Reading, Pa., which is just entering the typewriter and music box business is counted upon as a purchaser, and another, lately organized, located in Jersey City, will doubtless be in evidence also. The Eastern railroads have not yet begun to buy with freedom. In the bicycle line some few manufacturers are adding to their plants. Recent demand springing from the electrical industry has been characterized rather by the orders placed by the General Electric Company for some $80,000 worth of tools for its new building than by miscellaneous buying.

Contracts for some $75,000 worth of machine tools for use in building horseless carriages were being figured upon this week. The machinery is destined for shipment to Europe, but a party at Hartford, Conn., is negotiating the enterprise. The contract will comprise thirty-two lathes and other tools, and will, it is said, make a good dealers' order. A seller just returned from Hartford as a participant in the scramble reports that the bids are close. Another order for horseless carriage building purposes, and involving machine tools and fixtures to the amount of about $100,000, is expected to be placed before the 1st of next May. These carriages will, it is said, be built in America for foreign shipment.

The John Good Cordage & Machine Company, Brooklyn, N. Y., lately gave out orders on which the estimating was well distributed, with the result that nobody was enriched very much, but several were enriched a little. The A. B. Farquhar Company, York, Pa., agricultural implement manufacturers, have placed a machine tool order, known of in this market, but it is said to have gone to a Philadelphia concern.

The Niles and the Pond machine tool companies are both very busy, the former working nights. Bement, Miles & Co. are finding the large amount of work on their hands still growing. The Putnam Machine Company is experiencing an improved demand. The works of the Long & Alstatter Company and of the Draper Machine Tool Company are well filled with orders. The latter, which has made an extensive addition to its shops and installed new tools, has put on thirty extra hands within a month. Among the New England concerns of whose flourishing condition we have heard are: P. Blaisdell & Co., H. C. Fish Machine Company, Flather & Co., Flather Planer Company and Prentice Brothers.

A sign of a healthy market is the fact that prices are still quite strong. Some advances, even, are stated to have been made during the past month. For instance, a firm whose works are located not far from New York city has just announced that since its business is good it intends to make hay while the sun shines, and in pursuance of that policy has put up the price of some of its tools 5 per cent. So far as prices have been advanced by most companies the change seems to have been made at a former period. The higher figures now existing than those prevalent at the beginning of the year seem to be more particularly on large tools. The price question has two sides to it, and, as elsewhere we intimate, there are those who still complain of sharp concessions. A 36-inch by 14-foot lathe is said to have sold for $775, though an ordinary price for such a lathe is $1,150 or $1,200. It is stated that 14-inch lathes may be had at $170, "and good ones, too."

THE WOOD-WORKING MACHINERY MARKET

shows a perceptible improvement even in this part of the country, although the situation here is not as favorable as in the West. Local trade has manifested itself principally in a multiplicity of small orders. By a representative of a leading company having an office in this market, which makes a specialty of machinery for car building, we are informed that while this line of trade in the East has of late been quiet, the inquiries now on hand are such as to indicate an active future. The Globe Machine Company, Chicago, has been taken into the American Wood-Working Machinery Company, as is stated at an office of the latter. The results of the consolidation of the concerns comprising the American Wood-Working Machinery company, which has now been in operation for the greater part of a year, have been chiefly felt in its internal arrangements. Prices have not been materially influenced, nor have the interests of outside companies been greatly affected, either detrimentally or beneficially. Whoever supposed that it would become a monopoly has failed to see his anticipations verified.

THE "COLONIAL" MARKET.

Mr. Osgood Welsh, one of the best authorities on Cuban economic questions in this city, said recently in a press interview: "There is unquestionably a large field in Cuba for the construction of electric street railways, lighting plants, water works and other enterprises of like character. But before these can be safely attempted the people of Cuba must have some money to spend, must be able to pay their taxes and must have a renewed faith in the protection of their lives and liberties which settled government can afford."

An export firm was in the market this week for about $12,000 worth of sugar machinery and material for shipment to Cienfuegos, Cuba. Some further orders for plantation and railroad supplies will be placed as soon as the public horizon is a little clearer. A large amount of material is now awaiting shipment, but is delayed owing partly to a fear that the Spanish officials as their tenure of office draws to a close will exact heavy duties. On many plantations the grinding of cane will not begin until January.

This week's transactions for the Cuban market also include the sale of a medium sized stationary engine for a plantation and 800 tons of steel rails. There is a favorable opportunity in Santiago, it is said, for the establishment of an ice plant, in addition to one now under construction, of a sawmill and of a modern machine shop.

CHICAGO MACHINERY MARKET.

Not only is the machine tool trade more active, but there has been the com-

mencement of better prices. The agent of one Eastern factory was advised last week that, effective October 1, the price of machines would be advanced. The factory was induced to mark up values not only on account of the more active trade, but because of the higher prices of both labor and material. An advance in prices is not general, but it is becoming easier for makers to take this action. There is an accentuation of the slowness of deliveries. The senior member of a prominent selling agency here remarks that they ordered from an Eastern factory last January a line of machines, expecting deliveries to be made in about three months. Now, at the expiration of nine months, all of these goods have not been forwarded. The delay was not caused by directions from the buyer to withhold shipment, but by the inability of the manufacturer to complete the order. Another seller states that he has just sold a large planer, delivery of which cannot be made for five months. Two, or at the farthest three, months would have suited the buyer much better. Even among wood-working machinery manufacturers there is now a stronger sentiment. One Saginaw, Mich., toolmaker writes to his representative that the factory is becoming well filled and that a continuation of their present business would soon snow them under.

It is the rule for the trade here to report a larger volume of business for September than for either the previous month or for September last year. The percentages of increase vary from about 10 to 20 per cent. There are no known exceptions to this favorable statement, and the trade has been pretty thoroughly canvassed. There is an almost total absence of jubilation over the changing conditions. It has been coming too gradually to evoke high spirits, and in fact there is not yet as much business as is reasonably desired. The head of one house, commercial not manufacturing, says that they have almost as much trade as they can take care of. That, as opinions go, is one of the more favorable. The new tools that are being sold are going into almost all lines of trade. Among the railroads that have been recent buyers is the Santa Fé. The territory that is buying is general, and both large and small machines are marketable.

Wood-working machinery has been more active. A large lumber concern in the Northwest has arranged to build a $100,000 mill, and has purchased for it tools to the value of $15,000. A salesman for a picture frame molding manufacturer asked to be ordered in from the road. He says life has been a torment to him because he everywhere heard words of complaint because goods were not forwarded as fast as needed. That manufacturer has just bought six new machines to help him catch up with his orders.

The American Wood-Working Machine Company has sold more machinery during September than any month in the year.

PITTSBURG REPORT.

Conditions in nearly all lines of trade have improved somewhat during the past few weeks. In most departments of business the demand has increased, and while there has not been any material advance in prices, great hopes are expressed that some decided advance will be noticed in the next month or so.

In the raw iron market the production has been exceedingly heavy, nearly all the furnaces in the Pittsburg territory being in blast. Another one, the new Edith furnace, in Allegheny, will begin operations in about ten days. The weekly production is averaging about 56,000 tons at present, and the prospect that an increased output will be found to have characterized the month of September is very bright. Bessemer pig is pretty well sold up and is bringing about $10.50@10.65 per ton. The Bessemer sales are now so controlled by the Mahoning and Shenango Valley furnace operators that the market is practically in their hands. Billets have been making a spurt for some few weeks past and are bringing about $16.25@16.50. Sales have been moderately good and mills are running to fair capacity.

Among the foundries there is plenty of work on hand and much iron is being melted. No. 1 foundry iron is bringing about $10.40@10.50 and No. 2 is being sold at $9.75@10. Mill iron is coming gradually to the front, acting in sympathy with the foundry grades.

Machinery builders of the heavier type, such as that for rolling mills, have been running regularly, and at the present time much work is being figured on. Several Pittsburg parties have secured a portion of the outfit for the new steel plant of the Alabama Steel & Shipbuilding Company, at Ensley City, Ala. The Frank-Kneeland Machine Company has contracted to furnish a 44-inch blooming mill, weighing 600 tons, while the Riter-Conley Company secured the contract for steel castings, hydraulic cylinders and all plate and structural work. The equipment will require about 400 tons of steel castings alone, while the total tonnage of steel material will be about 2,000 tons. The

Continued on page 41.

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Business Specials.

Gear wheels, gear cutting. Grant; see page 20.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Send for my water tube boiler catalog. E. P. Watson, Elizabeth, N. J.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

For Sale or Rent—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Pattern-maker wants steady situation. A. Maag, 330 Berry street, Brooklyn, N. Y.

Experienced machine designer having shop training; graduate. Box 271, AMERICAN MACHINIST.

Graduate mech. engineer, 28 years old, up in modern machine shop practice. Box 272, AM. MACH.

A first-class tool-maker wants position; has had charge; first class refs Address Box 14 AM. MACH.

Position as foreman pattern-maker; 15 years' exp. on engine work; 5 years as foreman. Box 7, AM. MACH.

Wanted—Position by first-class mechanical draftsman; ten years' experience. Box 12, AM. MACHINIST.

Mechanical draftsman desires position in New York; 17 yrs.' shop and office experience. Box 263, AM. MACH.

Foreman pattern-maker, competent draftsman, 15 years in charge. Scott, 65 Monmouth st., Newark, N. J.

Erecter, tool-maker and draftsman wants position; charge of shops seven years; try me. R. D. 89 East North street, Buffalo.

Situation wanted as foundry foreman; twenty-five years' experience on all classes of work. E. W. Cadwell, 1034 West Eighth street, Cincinnati, Ohio.

Experienced and competent mechanical draftsman desires to make a change; well up in the design of dynamos, motors and electric cranes. Address Box 15, AMERICAN MACHINIST.

Wanted—Position by Eastern man, ten years in charge designing and building special labor saving machinery and tools; well versed in general manufacturing. Box 18, AMERICAN MACHINIST.

Wanted—Position as mechanical superintendent by m. e.; exp. designer of special labor saving mach'y and tools; systematic shop m'g'r with high executive ability. J. Adams, 1768 Humboldt Boulevard, Chicago.

Superintendent of mach tool works desires a change; practical mach't, pattern-maker and mech. eng.; up-to-date on modern design, shop methods, cost system and correspondence; A1 references. Box 10, AM. MACH.

First-class position wanted by a practical tool-maker and general machinist having at present full charge of all machinery in a large plant; understands handling of men; age thirty-five years. Box 5, AM. MACH.

An experienced mechanical engineer and expert machinist, M. Am. Soc. M. E., having office in New York city, desires to represent engineering firm; steam and hydraulic machinery, tools, &c.; has connection in foreign country. Address Box 11, AM. MACHINIST.

An engineer, machinist, draftsman and electrician; served regular apprenticeship; successful as journeyman; foreman mach. shop; chief engineer and master mech factories and office bldgs.; desires pos. in line with his exp. or as ass't on large plant. Box 9, AM. MA.

Wanted—A position as machinist by a steady, temperate, married man of thirty five; an all-round workman with fifteen years' experience; capable of doing a large variety of work or to take charge of shop; understands double entry bookkeeping and the construction of time and labor saving devices. Address Box 16, care of AMERICAN MACHINIST.

Wanted—Position by a practical mechanic who has had experience in handling from ten to twelve hundred men systematically; fully capable of originating special tools devices and machinery for light manufacturing, such as bicycles, sewing machines, &c.; no objection to going abroad; exceptionally good references. Box 2, AMERICAN MACHINIST.

A practical man with an extensive and successful exp. in the handling of factories, manufacturing engines, electrical apparatus, saw mill, power transmitting, mining and general machinery, wishes to correspond with parties requiring a sup't or manager who has made economical production a special study; salary or an interest. Address Box 6, AM. MACHINIST.

Help Wanted.

Mechanical engineer as draftsman; experience with machines and tools for working light sheet metals (presses, dies, &c.) required; offers stating experience, salary expected, references, &c. Address to Niagara Machine & Tool Works, Buffalo, N. Y.

Experienced foundry foreman wanted, within 50 miles of New York, to run about twenty men, on best class of machinery work; must be capable, reliable, sober and married; reply giving full particulars of age, exp. and pay expected. Ad. Box 17. AM. MACH.

Wanted—By a company mfg. a general line of engine work, ambitious young men who have served their regular apprenticeship and are looking for a permanent position in a shop where faithful service is appreciated; in replying state size and kind of machine and work you are most accustomed to; state wages desired. Engine Company, care of AM. MACHINIST.

Help Wanted—Continued.

Wanted—Foreman for high speed engine shop; state experience, age and pay expected. Box 257, AMERICAN MACHINIST.

Wanted—Foreman for shop in Philadelphia building high grade, light and heavy mach'y; state age, exp., salary desired and ref. Box 13, AM. MACH.

Wanted—A few first-class machinists; also two bench men; must be familiar with water wheels, paper mill and electrical machinery. Ad. Box 4, AM. MACH.

Wanted at once a first-class traveling man for an Ohio supply house to travel in Ohio and Indiana. Address Supply, care AMERICAN MACHINIST, New York City.

Wanted—Competent man for foreman in machine shop; one familiar with water wheels and other heavy machinery; must come well recommended. Address Box 3, AMERICAN MACHINIST.

Wanted—An experienced mechanic competent to handle an important agency for machine tools in a large city; must have the highest testimonials and exp. as office man; all communications will be treated as strictly confidential. Address Box 241, AM. MACH.

Wanted—An instructor in forging for technical school; must be thoroughly skilled in all branches of the trade and familiar with power forging; must also have taste for artistic forging, be between twenty-five and forty years of age, and possess a fair education; salary $1,200 to $1,500 first year. Address Technical School, AMERICAN MACHINIST.

Wanted for works in England first-class draftsman as designer of small tools, jigs, cutters, etc., for use on hand and automatic screw machines, milling machines, etc.; good job for capable man. Reply, giving full particulars of experience, age, salary, etc., to Box 243, AMERICAN MACHINIST.

Wanted—An energetic gang foreman; must be accustomed to engine and general machine shop work; will be required to handle about twenty men; must be able to work from drawings; this is a good opening for a bright young man; state age, experience, nationality and give reference as to character and ability. Address Box 8, AMERICAN MACHINIST.

Wanted—As foreman of tool and mach. shop, a person having large exp. in designing and making special tools for light metal working; exp. in the handling of men and in shop manag'm't; pos'n perman't and compensat'n liberal to a person posses'g the right qualifications. Ad. in own handwriting, stating age, exp., refs. and sal. exp., E. W. R., 9 Murray street, New York.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Philadelphia Book Co., Phila., Pa., catalog free.

Caliper catalog free. E. G. Smith, Columbia, Pa.

Book, Dies & Die Making, $1. J. L. Lucas, Prov., R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

To buy working drawings and patterns, either or both, for an up-to-date lathe in sizes 14 in. by 6 ft. and 18 in. by 8 ft. Ad. Alexander, care AM. MACHINIST.

Wanted—A 28 or 30 inch lathe, 12 foot bed; 42 inches by 12 feet planer, two heads; must be modern tools; give full description and price f. o. b. cars. Box 266, AMERICAN MACHINIST.

The advertising department of the American Machinist has on hand 20,000 draftsm'n's thumb tacks; will send a box of ten to any draftsman in America on request; could use a postage stamp on box, but will send the tacks anyway.

Institutions retiring from business having machine tools, brass or wood working machinery, will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach Co., 55-59 Woodbridge st., W., Detroit, Mich.

For sale—On account of death, 15 horse-power engine, 20 horse-power boiler, in good condition; 20 feet of 2-inch line shaft, pulleys, hangers; one granite polishing machine; one drill machine for iron, very cheap. A. Durkes, 652 Lewis street, Union Hill, N. J.

The CROSS OIL FILTER

actually reduces oil bills 50% or more. Sent on approval. Capacities 3 to 120 gals. per day. Used in 18 countries. Testimonials from the leading firms in every field of industry.

THE BURT MFG. CO.
AKRON, OHIO, U. S. A.

Business Established 8 Years.

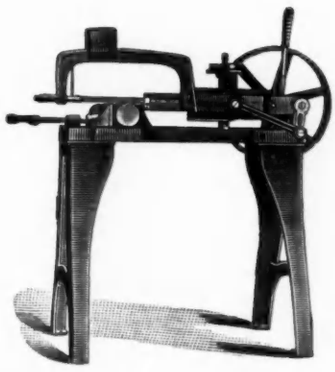
Largest Manufacturers of Oil Filters in the World.

"The best is as good as any."

The New

Automatic and Gravity Feed

Q & C Shop Saw



Cuts { Tool Steel, Machinery Steel, Iron, Brass and All Other Metals.

Price—'Way Down.

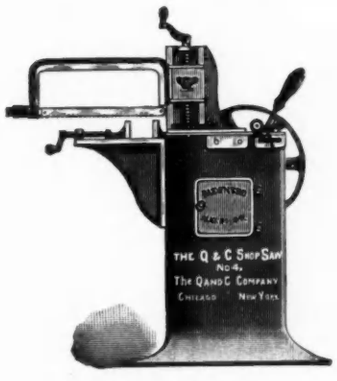
Quality—'Way up.

Shop Saws,

Portable Rail Saws,

Cold Power Saws,

For All Purposes.



Send for Catalogue.

Q & C Company,

Chicago. New York.

LONDON: Chas. Churchill & Co.
PARIS: Hounsfield & Fils.
BERLIN: Schuchardt & Schutte.
MADRID: J. G. Neville & Co.

Continued from page 40.

Totten & Hogg Iron & Steel Foundry Company, Pittsburg, has received an order for a standard 12-inch train of rolls complete for the Burgess Steel & Iron Works, Portsmouth, Ohio.

The Leechburg Foundry & Machine Company has awarded several contracts for the erection and equipment of its new plant at Homestead. It has not been definitely decided whether to use gas or steam engines for power. The Monessen Steel Company, which is to erect a plant at Monessen, Pa., on the Monongahela River, has placed contracts for the erection of buildings, and will soon award the contracts for the other work. The plant will be used for the manufacture of hoops and cotton ties, and will be complete in every respect. It is rumored that the Bessemer Furnace Company, of the Mahoning and Shenango Valley, will erect a $2,000,000 steel mill.

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Quotations.

NEW YORK, Monday, October 3.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 25 @ 11 50
No. 2 foundry, Northern	10 75 @ 11 00
No. 2 plain, Northern	10 50 @ 10 75
Gray forge, Northern	10 00 @ 10 25
No. 1 foundry, Southern	11 25 @ 11 50
No. 2 foundry, Southern	11 00 @ 11 25
No. 3 foundry, Southern	10 75 @ 11 00
No. 1 soft, Southern	11 25 @ 11 50
No. 2 soft, Southern	10 75 @ 11 00
Foundry forge, Southern	10 00 @ 10 25

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.30 @ 1.35c.; refined, 1.35 @ 1.50c.

Tool Steel—Base Sizes—Standard quality, 6 @ 7c., with lower prices on some brands; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary grands, from store, in small lots, 1.45 @ 1.50c.

Cold Rolled Steel Shafting—Base sizes, from store, 2.20 @ 2.25c., according to quantity.

Copper—Carload lots, Lake Superior ingot, 12¼ @ 12½c.; electrolytic, 12 @ 12⅛c.; casting copper, 11¾ @ 12c., for ordinary brands.

Pig Lead—Carload lots, 3.95c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 16.25 @ 16.35c., f. o. b.

Spelter—Carload lots, 4.85c., New York delivery, for ordinary brands.

Antimony—In cask lots: Cookson's, 9½ @ 9⅝c.; Hallett's, Japanese and French E. B., 9c.; United States, 8.70 @ 8.75c.

Lard Oil—Prime city, ice pressed, 42 @ 43c., in wholesale lots.

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Manufacturers.

An addition is being built to the auxiliary planing mill of E. T. Hartwell, Bangor, Me.

Henderson & Co., of Hampton, Ga., will add an electric light plant to their mill.

C. H. Wing & Co.'s machine shop at Carthage, N. J., has been almost entirely destroyed by fire.

The Remington Paper Mills, Watertown, N. Y., are to erect a new mill, which will be 260x70.

The Philadelphia Commercial Museum contemplates the erection of a new boiler house, to cost $40,000.

The American Emery Wheel Works recently moved into its newly constructed works at Providence, R. I.

The Kansas Cement Plaster Company, of Hope, Kan., is making arrangements to double its present capacity.

Ground is being broken for the extension of the machine shop by the Ludlow Manufacturing Company, Ludlow, Mass.

The Pittsburg Wire Company, of Braddock, Pa., has made a large land purchase, buying from W. T. Mellon a tract of land 500 by 200 feet, on Ninth street, Braddock, for $30,000. It

will be utilized soon on which to erect a new wire mill, containing about sixty machines, employing 350 men.

The Tennessee Coal, Iron & Railroad Company of Birmingham, Ala., is about to erect a new foundry, 240x80 feet, at Ensley, Ala.

The Cramp ship and engine building firm, Philadelphia, is preparing to erect a new shop on the east side of York street, Philadelphia.

The Sigourney Tool Company, Hartford, Conn., is to build a brick factory, 42x80 feet, two stories high, on the north side of Cushman street.

The Peoria Cordage Company, Peoria, Ill., will put up a new storehouse, 42x150, three stories, and a new machine shop, 32x40, three stories.

The McElwee Backing Company, Johnston City, Pa., have found it necessary to enlarge their plant by the addition of new and more modern machinery.

The Brown-Bonnell Iron Company, Youngstown, Ohio, is having plans perfected for the erection of a continuous mill costing $150,000, to be ready for business January 1.

The New Process Twist Drill Company, Taunton, Mass., is bringing out a new tool for boring cored holes. It has four spiral flutes, which are forged instead of being milled.

There will be a cotton factory established at Cherryville, N. C., by Rudasill & Alderholt, of that town. They will erect a brick building for the accommodation of 2,500 spindles.

The A. H. Nilson Machine Company, of Bridgeport, Conn., has been incorporated, with a capital of $5,000. The directors are Axel H. Nilson, H. Olson and William Nilson.

The machine shop of John R. Price, at Stonersville, Pa., was recently completely destroyed by fire, and Mr. Price would be pleased to receive catalogs from machinery manufacturers.

Geo. R. Whiting, Unionville, Mass., is rebuilding his extracting plant and will put in latest improved machinery, and expects to be ready to start before long. His mill was damaged by fire August 9.

Lockwood Greene & Co., of Boston, are the mill engineers of the new silk finishing works at Lodi, N. J. The contract has been awarded to John W. Ferguson, of Paterson. The plant will cost about $100,000.

Calhoun, Ga., is to have two new roller mills. Black & Co. will put a 50-barrel process in at the Oothcaloga Mills and Cook & Strain have bought ground on which they will commence work at once erecting a steam mill.

Holmes, Booth & Haydens, Waterbury, Conn., are making extensive repairs and additions to their plant. The Berlin Iron Bridge Company, East Berlin, Conn., have secured the contract for the steel roof work for the boiler room, 40x80 feet; the new muffle room, 35x80 feet, and the new brass mill, 118x90 feet.

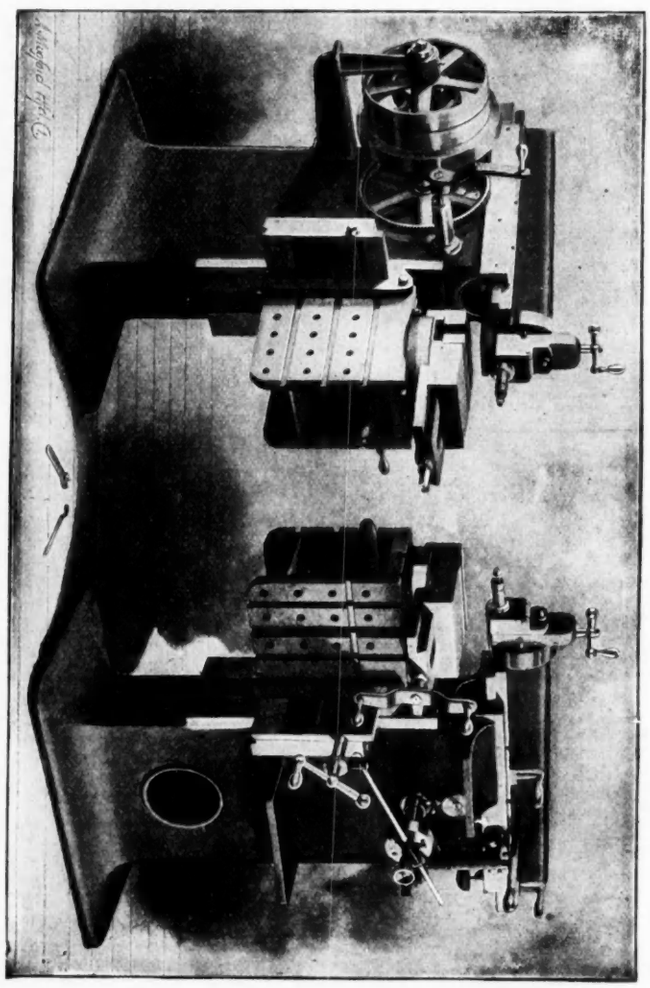
Several important additions and changes are being made at the Norton Emery Wheel Company's plant, Worcester, Mass. Prominent among them is the construction of an 18-foot kiln. The general manufacturing capacity is being largely increased also by the addition of a building 50 feet square at the rear of the establishment.

The Safety Emery Wheel Company, Springfield, Ohio, recently began the erection of two additions to its plant. One addition, 80x40 feet, will be made to the machine shop, and another, 20x120, to the kiln room. This will enable the company to double its present force. Two kilns will also be added. The new buildings will be equipped with modern machinery.

The Port Chester (N. Y.) Electric Lighting Company has just purchased the plant and franchises of the Westchester Gas & Electric Company and will begin in a short time to build an entirely new plant to supply the villages of Port Chester, Rye, Harrison and Mamaroneck. The capital stock of the new company is $50,000, and the officers are William E. Ward, president; J. Addison Johnston, vice-president; William L. Ward, treasurer, and Walter S. Comby, secretary.

15-inch Pillar Shaper.

A FRICTION driven machine, fitted with a positive locking device for friction, insuring a uniform length of stroke under a heavy cut. Stroke can be changed to any position with ram in motion; has quick return; and our micrometer adjustment makes possible the most minute variation in length of stroke, which can be constantly varied with machine in motion; an especially valuable feature in tool and die work and in planing to irregular lines.

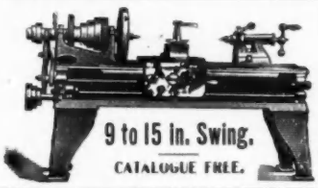


THE HENDEY MACHINE CO.,
Torrington, Conn.

AGENTS FOR THE PACIFIC COAST:
PACIFIC TOOL AND SUPPLY CO., ... San Francisco, Cal.
J. W. CREGAR, ... Philadelphia Bourse Exhibition.

EUROPEAN AGENTS:
SCHUCHARDT & SCHUTTE, . . . Berlin, Vienna, Brussels.
CHAS. CHURCHILL & CO., Ltd., London and Birmingham, England.
ADOLPHE JANSSENS, ... Paris, France.

SPENCER AUTOMATIC MACHINE SCREW CO. Now Located 111 SHELDON STREET, HARTFORD, CONN., U. S. A.



ENGINE and SPEED LATHES

IN VARIOUS LENGTHS—9 to 15 in. SWING.
Latest and Most Approved Designs. Workmanship, Material and Finish of the Highest Order.

SEBASTIAN LATHE COMPANY,
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Agents: SELIG, SONNENTHAL & Co., London, Eng.; JOHN TRAGARDH & Co., Goteborg, Sweden; E. SONNENTHAL, JR., Berlin, Germany; R. S. STOKVIS & ZONEN, Rotterdam, Holland.

Thermo-Dynamics of the Steam Engine and other Heat Engines.
By C. H. PEABODY,
Professor of Marine Engineering and Naval Architecture, Massachusetts Institute of Technology
Fourth Edition. Rewritten and Reset.
8 vo, CLOTH, $5.00.
JOHN WILEY & SONS, 53 East 10th Street, New York City.

HIGHEST QUALITY—TAPS, DIES, REAMERS,
Screw Plates, Tap Wrenches, Bolt Cutters, Drilling Machines, Punching Presses, Etc.

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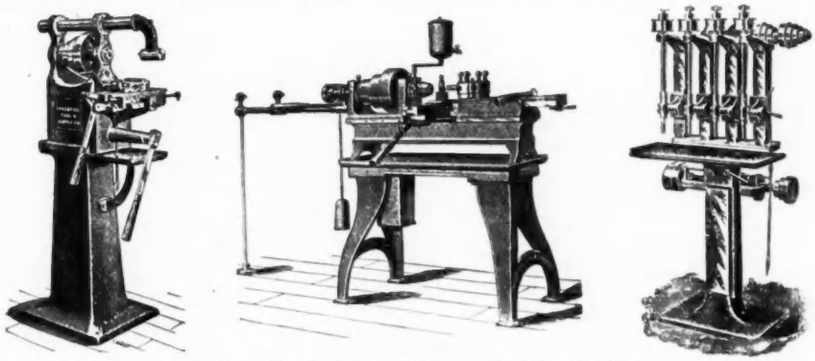
Agents in London, SELIG, SONNENTHAL & CO., 85 Queen Victoria St.

WE CLAIM THE FOLLOWING MERITS FOR **JENKINS BROS.' VALVES.**

1. Manufactured of the best Steam Metal.
2. No regrinding, therefore not constantly wearing out the Seat of the Valves.
3. Contain JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
4. The Easiest Repaired, and all parts Interchangeable.
5. Every Valve Tested before leaving the factory.
6. ALL GENUINE stamped with Trade Mark.

JENKINS BROTHERS, New York, Philadelphia, Chicago, Boston.



LATHES, PLANERS, DRILLS, SHAPERS, MILLING
AND SCREW MACHINES, ETC., ETC.

PRENTISS TOOL & SUPPLY CO.,
MACHINE TOOLS. COMPLETE SHOP EQUIPMENT.
EXPORT TRADE A SPECIALTY.

CABLE ADDRESS:
"PRENCO."
Lieber's Code.

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NEW YORK.

No. 2.

WINKLEY'S PATENT
Dust-Proof Oil-Hole Covers.
9 SIZES.
A substitute for loose plugs.
Over one million in use.
Adopted by many of the leading machinery builders
F. D. WINKLEY, 534 Francis St., Madison, Wis.
London: Chas. Churchill & Co., Ltd., 9-15 Leonard St. Berlin: Schuchardt & Schutte, 36-41 Spandauer-strasse.

WANTED!
Machinery, second-hand; must be in first-class order.
36 in. or 38 in. swing lathe, with compound rest, 15 or 16 ft. centers.
12 ft. boring mill, either with single or double head.
400 or 500 lb. steam hammer.
600 lb. steam hammer.
Die sinking machine.
2 x 24 Jones & Lamson flat turret lathe.
C. C. WORMER MACHINERY CO., Detroit, Mich.

New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

From the Walker Company, Cleveland, we have received circulars No. 1,080 to 1,086, describing boosters, car motor, alternators, generators and controllers. Sectional views of the various machines are shown. All the circulars are 8x10¾ inches.

From the F. W. Gesswein Company, New York, we have received catalog of tools and appliances used by dentists, polishing lathes, screw plates. The variety of tools shown is large, and accompnying each article is the price. The catalog is profusely illustrateed and is 7x10¾ inches.

The Safety Car Heating & Lighting Company, New York, has issued a catalog which bears the title "Safely Thro' the Waters" and in which press comments on the merits and advantages of the Pintsch system of gas lights for stationary lighthouses, buoys, etc. The catalog is 5½x7¼ inches.

W. H. Nicholson & Co., Wilkesbarre, Pa., have sent us catalog illustrating and describing expanding lathe mandrels. These mandrels are made in sets of nine and take every possible sized hole from 1 to 7 inches diameter, inclusive. The catalog contains a number of testimonial letters, and is standard size, 6x9 inches.

From the San Francisco Bridge Company and New York Dredging Company, San Francisco and New York, we have received catalog describing and illustrating methods by which bridge building and dredging are accomplished. The catalog contains a number of illustrations showing various examples of work done by the companies named. The catalog is standard size, 6x9 inches.

From the Faneuil Watch Tool Company, Boston, Mass., we have received 1898 catalog of lathes and tools used by tool-makers, electricians, watchmakers and model makers. The tools described include grinders, milling machines, presses, also grinding, slotting and cutter milling attachments. The catalog contains a large numbers of illustrations, 106 pages and is 5¼x8 inches.

The Joseph Dixon Crucible Company, Jersey City, N. J., has published a pamphlet entitled "Helps in Brazing," which treats of the process of brazing by the dipping method, which is accompanied by the use of a crucible so shaped as to permit the brazing of almost all joints in a bicycle frame. The pamphlet is of interest to bicycle makers and will be sent to those interested on application.

We have received from the General Electric Company bulletins from No. 4,023 to 4,147, in which are described in detail generators, motors, rheostats and a variety of other electrical machinery designed for the complete equipment of electric street railways and electric lighting plants. The bulletins are filed in a binder, and the total number of pages is about 368. Each bulletin is 8x10½ inches.

We have received from the New Britain Machine Company, New Britain, Conn., two catalogs, one of which describes the Case automatic high speed engine, and the other chain saw mortising machines. The engine referred to is made in sizes from 2½ to 25 horse-power. The engine is so constructed as to call for the fewest

We Make **Boring Machines, Milling Machines, Special Tools** BEAMAN & SMITH, PROVIDENCE, R. I.

working parts and of light weight; at the same time accessibility to the engine is a prominent feature of its construction. The mortising machine is very fully described. These machines are made in several sizes. The catalog contains a number of testimonial letters and also some press opinions. Both catalogs are standard size, 6x9 inches.

We have received catalog of steam hammers from B. & S. Massey, Manchester, England. This firm makes hammers suitable for smith work, forge work, steel tilting, steam hammers for flue welding and copper work. The catalog is divided into sections, and is provided with a thumb index, enabling one to turn directly to the class of hammer wanted. The catalog contains 134 pages and is 6½x8¼ inches.

The American Emery Wheel Works, Providence, R. I., has issued new catalog of emery and corundum wheels, emery cloth, grinding machinery, and other appliances connected with the installation and maintenance of grinding machinery. The Walker Magnetic Chuck is also described, showing its applicability to grinding operations. Some useful information on speed of wheels, selection of same, etc., is included, and the catalog is 6x9¼ inches.

We have received from the Weber Gas & Gasoline Engine Company, Kansas City, Mo., Catalog No. 14, in which are described various styles of gas engines suitable for various purposes. In addition to this a number of appliances used by those engaged in contracting and building are included. A number of testimonial letters from users of the above mentioned company's product are presented. The catalog is standard size, 6x9 inches.

The Carborundum Company, of Niagara Falls, N. Y., sends us Catalog No. 2, in which is treated the history, development and manufacture of carborundum. It contains in full a lecture delivered before the Franklin Institute. Carborundum is used, among other things, for polishing granite, grinding steel balls, etc. It is also used as a substitute for emery in the manufacture of wheels. The catalog is highly interesting and is well worth sending for by those interested in the subject. It is 6½x9 inches.

We have just received from the Garvin Machine Company, New York, catalog of machine tools, including gear cutters, cutter grinders, screw machines, drill presses, etc. A number of new machine tools and milling machines are shown, and altogether the catalog is a complete one, the description of each machine being very thorough. A number of tables for calculating speed of pulleys, decimal equivalents, etc., are included and a telegraphic code for use by customers. The catalog contains 125 pages, and is 4x6¼ inches.

We have received from the Westinghouse Electric & Manufacturing Company, of Pittsburg, a pamphlet, which forms Part I. of the history of electric street railways. It contains a review of the development of Westinghouse motors as built for electric railway service. Illustrations of various types of motors are given and the peculiarities of their construction described. The pamphlet should be highly interesting to electric railroad officials as showing what has been, is being done and the prospects for the future. The pamphlet is standard size, 6x9 inches.

The Crescent Steel Company, of Pittsburg, Pa., has issued a pamphlet entitled "Steel Making," which as an example of fine presswork and taste in design is certainly admirable. The pamphlet contains a brief history of the commencement and development of the steel making industry in the United States. There are appropriately placed on each page views in the plants of the above mentioned company, products of the works, etc. The catalog is highly interesting, not only as a work of art, but as showing the immense growth of the steel industry in this country since its introduction. The catalog is 5¼x7½ inches.

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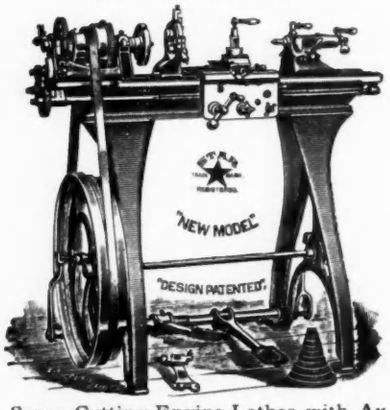

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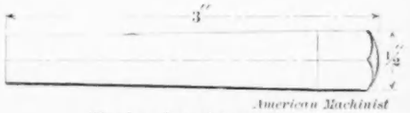

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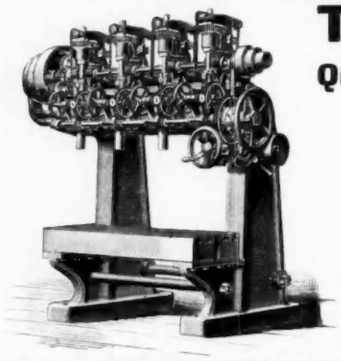

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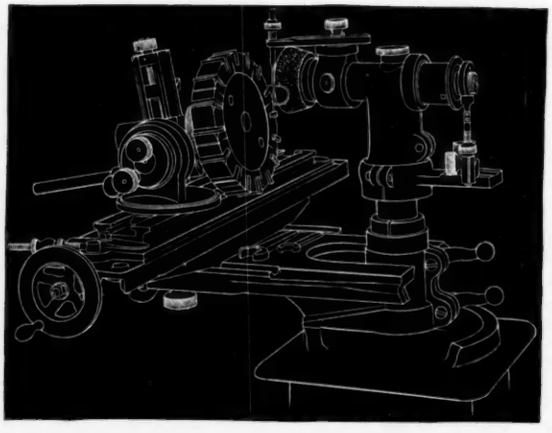

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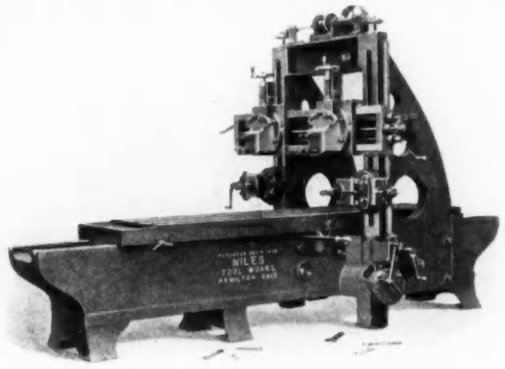

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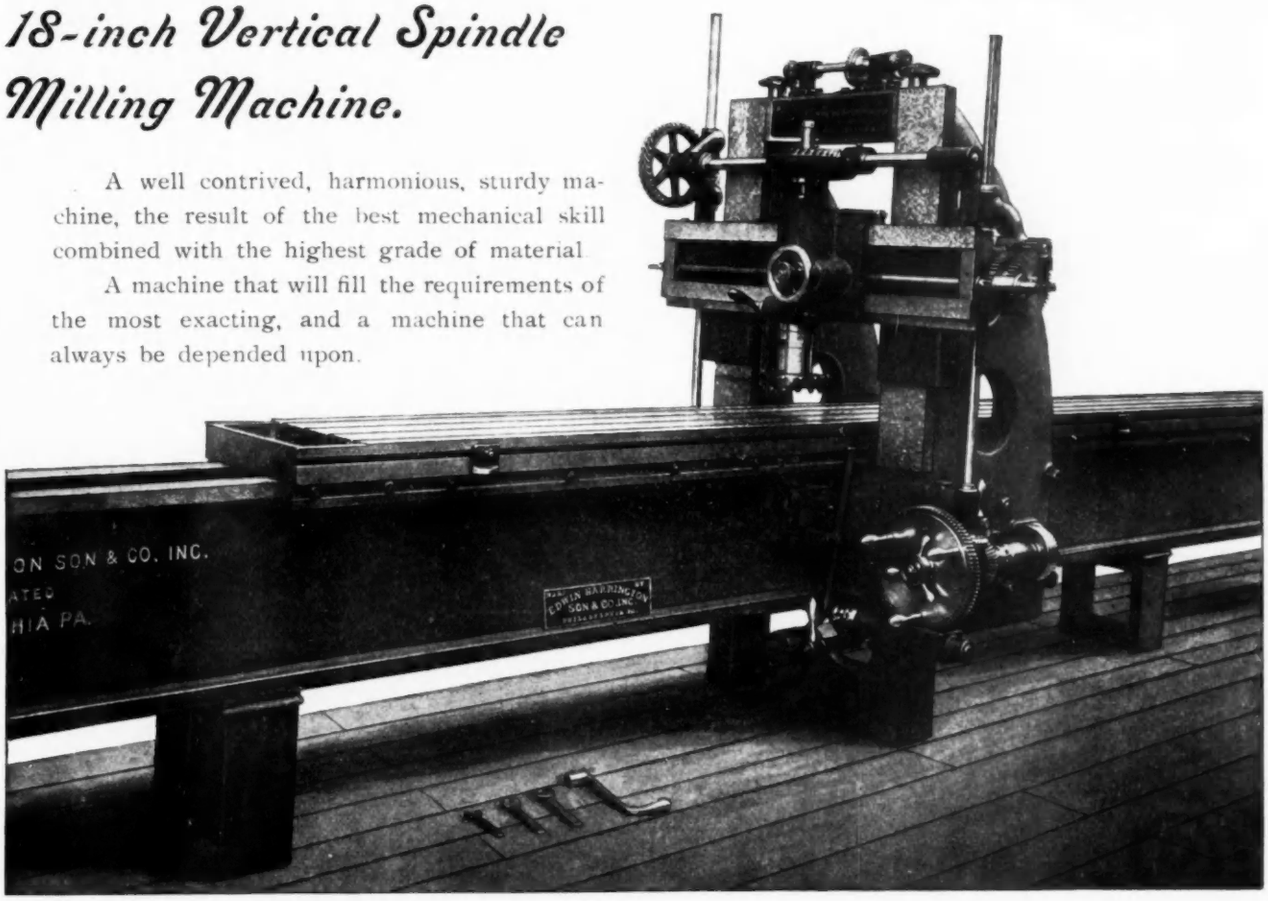

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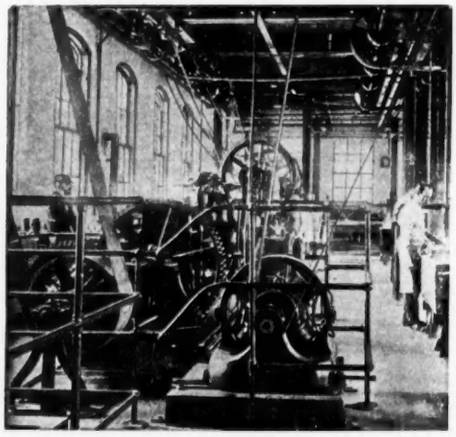

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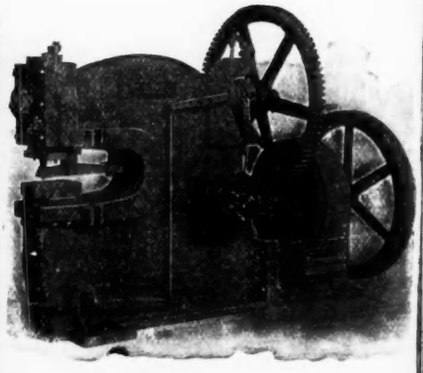

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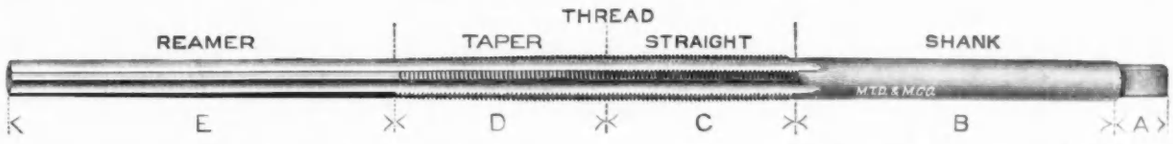

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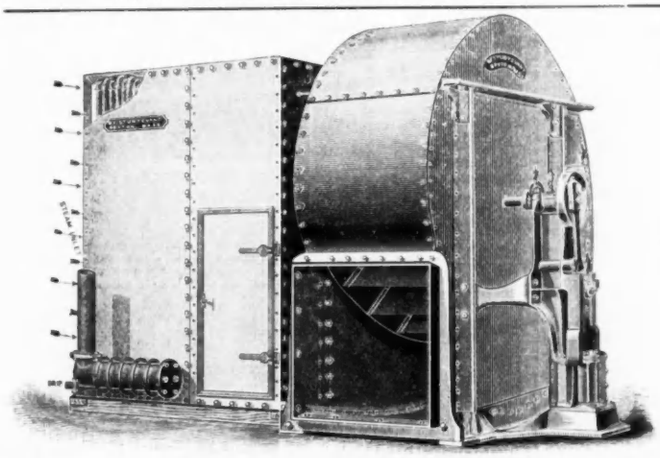

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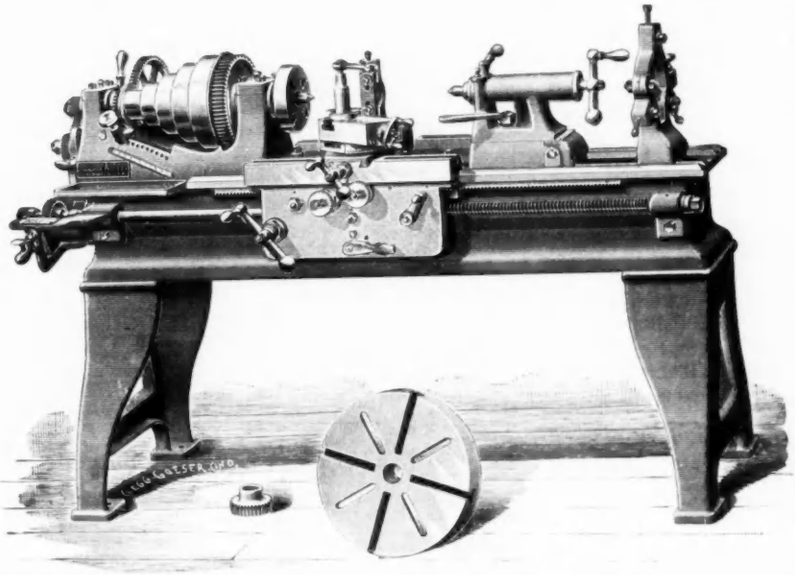

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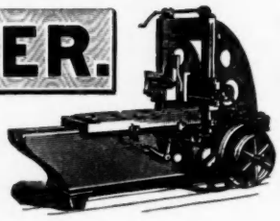

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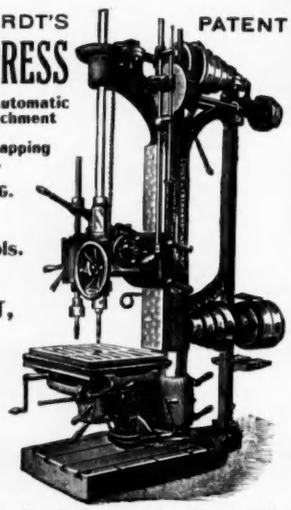

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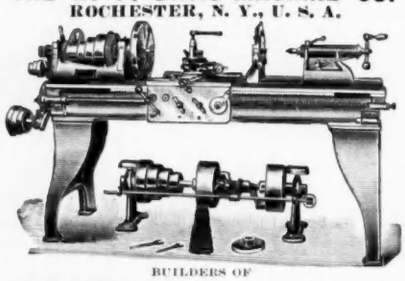

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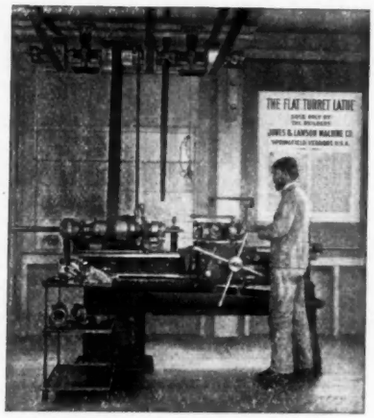

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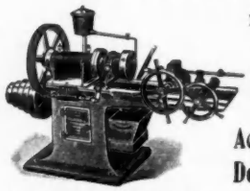

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